AGGRESSIVE DRIVING BEHAVIOUR: A FORENSIC PSYCHOLOGICAL PERSPECTIVE

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Thesis abstract

This thesis provides an investigation into aggressive driving behaviour, from a Forensic Psychological perspective. The methods used include a systematic review, two quantitative research studies, and a psychometric critique. A systematic review and meta-analysis of the relationship between a measure of driving anger, the Driving Anger Scale (DAS; Deffenbacher, Oetting & Lynch, 1994), and various aggressive driving outcomes showed a strong positive correlation. However, the validity of this finding is hampered by the extensive use of self-report questionnaires, as opposed to real-world driving behaviours, to measure aggression on the roads. The first empirical research study investigated the relationship between personality characteristics (including driving anger) and aggressive driving outcomes. The results showed that three variables accounted for more than half of the variance in self-reported aggressive driving behaviour. These were a tendency toward physical aggression, the progress impeded aspect of driving anger, and psychopathic tendencies. The findings provide ideas for future research, and intervention to reduce aggressive driving behaviours. The second research study expanded on this, and considered the impact of inattentive responding on outcomes for online surveys, and how these may relate to the driving aggression literature. This was enabled by the discovery that around a third of respondents to a survey failed instructional manipulation checks; inclusion of these participants in analysis obscured the results found in the first study. The findings are discussed in terms of practical implications for researchers. A psychometric critique of the Propensity for Angry Driving Scale (PADS; DePasquale, Geller, Clarke & Littleton, 2001) is also presented. This raised questions about the reliability and validity of the PADS, which will be of

interest to researchers considering driving anger and aggression in the future. The findings from each methodology are finally considered together, with a discussion of the implications for the field of aggressive driving research.

Thesis overview

Aggressive driving is costly to the driver and to society; it wastes fuel, is related to injury and mortality in pedestrians, cyclists, and drivers, and incurs huge indirect costs associated with policing and the legal consequences of the behaviour. This thesis aims to address issues and gaps within the field of aggressive driving literature, probing deeper into current understanding of the area from a Forensic Psychological perspective. The overarching theme of the thesis is to examine the personal characteristics that contribute to aggressive driving behaviours. The thesis comprises six chapters: a general introduction, a systematic review; two empirical research studies; a psychometric critique; and an overall discussion of the findings. Each has a different specific focus, within the broad theme of aggressive driving behaviour.

Chapter one gives an introduction to the thesis, including the reasoning behind its content and aims. The concepts of aggressive driving and driving anger are explained, as well as an indication of their impact in forensic terms.

Chapter two presents a systematic review and meta-analysis of the evidence regarding the link between a measure of driving anger (the Driving Anger Scale, DAS; Deffenbacher, Oetting & Lynch, 1993), and aggressive driving outcomes. The review draws together numerous studies in order to provide good quality evidence as to the strength of this link, with narrative and quantitative analysis.

In chapter three, an empirical study investigates the role of personality characteristics in aggressive driving, expanding on prior research in the area. In particular, this is only the second study to include the Dark Triad traits

(psychopathy, narcissism, Machiavellianism) as predictors of behaviour. The results provide an important contribution to the literature, and indications as to the direction of future research, as well as potential implications for policy.

In chapter four, a further empirical study examines the importance of considering participant attentiveness when conducting survey research in general, and in the context of driving research. This is an area that needs more research, as the implications matter to research integrity, reliability, and validity.

Chapter five is a critique of one of the measures of aggressive driving used in the empirical studies. The tool is not new, however its psychometric properties have not been collated before. The results have important implications for future research, as various questions are raised regarding the reliability and validity of the tool.

Finally, chapter six presents a discussion of the research findings, alongside potential implications for research, clinical practice, and policy; and suggestions for further research.

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CHAPTER ONE

General introduction to thesis

This chapter provides a general introduction to the research explored by this thesis, including an overview of the concepts under study, the importance of this from a societal and Forensic Psychological perspective, and my personal reasoning for choosing this particular topic.

1. Driver behaviour

Within the realm of driver behaviour there has been much focus on the factors that contribute to accident involvement. Driver skills and style have been widely studied. Skill refers to behaviours necessary to control the vehicle, including steering and gear control (perceptual-motor skills), and hazard perception (a higher order cognitive skill). Style, on the other hand, is a driver's chosen way of driving, including their speed and following distance. Research shows that hazard perception is a skill which develops with practise, so more experienced drivers are better at it than novice drivers (Crundall, 2016). Training can also improve skills in hazard perception (Petzoldt, Weiß, Franke, Krems, & Bannert, 2013), with associated decreases in errors that lead to crash involvement. Clarke, Ward and Truman (2005) found that, although skills deficits accounted for some young driver accidents in the UK, the strongest explanatory factor was voluntary risk taking, thus indicating that driver style may be more important than skills when considering accident involvement. Similarly, Martinussen, Møller and Prato (2014) found that drivers who self-reported higher

perceptual-motor skills also self-reported engaging in more style-related aberrant driving behaviours, and being involved in more accidents. Again, this supports the notion that driver style is important to consider when evaluating safety on the roads.

Varying methods have been used to study driver behaviour. Self-report questionnaires are generally quick, straightforward for the respondent, and cheap to administer to large samples, making them a popular choice across psychological research. These can be completed in person or online. However, there are limitations; particularly when completed online, there is little control in the administration environment, meaning outcomes may be affected by extraneous variables, unbeknownst to the researcher; and there is an inevitable compromise in the ecological validity where measuring self-reported intentions or actions. Driving simulator studies are also popular, and are considered to have more validity when researching real-world behaviours. However, simulators are expensive and therefore sample sizes tend to be smaller when this approach is used, with concomitant drawbacks relating to sample representativeness. Also, limitations are still present regarding validity – participants know their behaviour in a simulator does not have real-world, lasting effects, and variables such as the type of car they are used to driving or social desirability may impact upon behaviour. Few studies directly observe real-world driver behaviour, for obvious reasons – the ethical considerations around distracting a driver, practical considerations such as keeping pace with a driver if not in the vehicle, and financial costs of such studies. Innovations are needed in order to increase the validity of research on driver behaviour.

2. Aggressive driving behaviour

One of the lesser studied aspects of driving style is aggressive driving behaviour, which is not, as yet, a term with a generally accepted definition. This is partly due to the perceived overlap with other terms, such as 'dangerous' and 'risky' driving, and 'road rage'. The broader concept of aggression is often considered to describe behaviour that is intended to (or at least could be reasonably expected to) harm others (e.g. Novaco, 2011). This can be physical or psychological harm. However, when we try to apply this definition to the driving context, things become more complex; it is often impossible for anyone but the driver to know the intention of their manoeuvres. Nevertheless, individuals with a propensity toward general aggression also tend to score higher on measures of aggressive driving (Lajunen & Parker, 2001; Van Rooy, Rotton & Burns, 2006). Various definitions of aggressive driving have been suggested, and are detailed in chapter two. For the purpose of the current thesis, the working definition of aggressive driving is a follows: any behaviour committed by the driver of a vehicle with the intention of dominating the road, with potential to cause physical or psychological harm to other vehicle users. Behaviours that could be encompassed by this term include speeding, shouting, rude gestures, horn honking, flashing lights, tailgating, overtaking without adequate space, and using the vehicle to cause physical harm to another person.

As already noted, it can be difficult to establish whether a behaviour is aggressive or not. This makes it hard to measure aggressive driving behaviour. Ideally, naturalistic observations would be used to counter the problem. However, this is difficult, due to practical issues such as maintaining observation whilst on the move, and psychological factors such as socially desirable behaviour if the subjects knew they were being watched. It may be that new technology can make

this possible. Simulation studies are a plausible option, but again these are not without drawbacks, a major one being the time and cost of conducting driving simulator studies, and also potential selection bias (i.e., the over-representation of young university students). Therefore, the most frequent method for measurement of driving aggression is the use of self-report questionnaires. The benefits of these include brevity and low cost, providing the potential for large samples. Selection bias may again be present, but concerns around socially desirable responding are considered minor (e.g. Lajunen & Summala, 2003). At present, then, self-report questionnaires are the most widely available means for assessing aggressive driving behaviour.

3. Driving anger

The operationalisation of driving anger is somewhat easier to explain, given that there is just one widely used and validated tool to measure the concept. Deffenbacher, Oetting and Lynch's (1994) Driving Anger Scale (DAS) represents driving anger as a form of trait anger specific to the driving context. That is, feelings ranging from 'mild irritation or annoyance to intense fury and rage' (Spielberger, 1999, pp.1), on the roads. Driving anger has received much attention in the field of aggressive driving literature, as it is often assumed that anger is a precursor to aggression (e.g. Novaco, 2011). This may not always be the case, but generally research has found a positive association between scores on the DAS and aggressive driving outcomes.

4. Impact of aggressive driving behaviour

Although we cannot always be sure that a driver's behaviour is aggressive, going by the aforementioned definition, we can estimate the impact of aggressive driving behaviours on the roads. An estimated 90% of crashes in a recent US study were attributed to driver-related factors (e.g. error, impairment, fatigue, distraction; Dingus et al. 2016). In the UK, a Department for Transport report (2015) noted aggressive driving to be a contributory factor in 7% of fatal accidents and 3% of all road accidents in 2014. The American Automobile Association reports a much higher figure, with 56% of accidents from 2003-2007 thought to involve aggressive driving, most commonly speeding (AAA, 2009). Anecdotally, everyone can describe an incident where they saw a driver behaving aggressively. Many people may recognise times when they have engaged in this behaviour themselves, so committing a criminal offence with grave consequences that thankfully did not come to pass. Given the ever-increasing volume of cars on our roads, this is a problem we need to address.

5. The present thesis

The aims of this thesis are to build on previous research in the field in order to fill gaps of knowledge regarding the personal characteristics that contribute to aggressive driving behaviour. This topic was chosen because, despite the prevalence and negative impact of aggressive driving behaviour, it has not received the same attention as many other issues in Forensic Psychology. I therefore felt the topic was deserving of my focus, and that it could provide more opportunities for novelty and impact than the more commonly studied violent and sexual offending. Focusing on these behaviours in the general population, rather

than solely individuals who have received convictions for their driving behaviour, makes the research more applicable to the everyday context. Moreover, the behaviour is common, and not just committed by persons who might be stereotyped as 'criminal'. Considered more widely, the aim is to find out enough about the causes of driving aggression to reduce its harmful effects, whether via our teaching methods for drivers, psychological interventions, policy change, or the design of the roadways themselves.

Rationale for chapter two

Chapter one introduced the concepts of aggressive driving and driving anger, and their importance in a forensic context. A systematic review and meta-analysis was undertaken to try to establish the nature of the relationship between driving anger and aggressive driving behaviour, which is important if research in the area is to progress. This methodology allows for a multitude of results to be considered as a whole, particularly where meta-analysis is used. The outcomes will be discussed in terms of implications for the field of aggressive driving research, and practice implications for reducing the occurrence of aggressive driving.

CHAPTER TWO

A systematic review and meta-analysis of the relationship between the Driving Anger Scale and aggressive driving outcomes

Abstract

Aggression on the roads is a major problem, but as of yet it is still relatively poorly understood. One much-studied factor that may contribute to aggressive driving incidents is driving anger. The current systematic review and meta-analysis considers the relationship between a measure of driving anger (the Driving Anger Scale; DAS), and aggressive driving outcomes. Four online databases were systematically searched, as well as hand searching of relevant papers, resulting in 690 total publications being identified. Following application of inclusion and exclusion criteria, 13 studies were synthesised narratively, with 12 reporting a significant positive relationship between the variables of interest. Thirty-two additional studies were subjected to meta-analysis (N=9374), and showed a pooled correlation of r=0.41 (95%CI=0.36-0.46), indicating a moderate relationship between the DAS and aggressive driving outcomes. Implications for intervention and further avenues for research are considered.

1. Introduction

1.1. Anger and aggression

Anger is defined as 'a psychobiological emotional state or condition that consists of feelings that range in intensity from mild irritation or annoyance to intense fury and rage, accompanied by activation of neuroendocrine processes and arousal of the autonomic nervous system' (Spielberger, 1999, pp.1). Historically, it has been assumed that anger is present when violence is committed (e.g. Novaco, 2011). However, more recently researchers have acknowledged that 'anger is neither a necessary nor a sufficient condition for human aggression and violence' (Howells, 2004, pp.189). It is recognised that anger is a commonly experienced emotion, which does not result in violent behaviour the majority of the time. The literature remains unclear as to the extent to which anger can predict aggression and violent behaviour. For the purpose of this paper, the term 'aggression' will be used to refer to dominant interpersonal behaviour that causes or has the potential to cause physical or psychological harm. This therefore encompasses, but is not limited to, violence.

1.2. Anger and aggression on the roads

One area of life in which anger and aggression can manifest is in the driving context. The frustration-aggression model (Dollard, Doob, Miller, Mowrer & Sears, 1939) has been used in an attempt to explain this, the idea being that drivers frustrated by impediments to their progress or perceived poor behaviour from other drivers, might become aggressive in response. Since anger has commonly been suggested as a precursor to aggression (e.g. Anderson & Bushman, 2002; Berkowitz, 1990), Deffenbacher, Oetting and Lynch (1994) developed a measure of 'driving anger', which they conceptualised as a more context-specific version of trait anger. The original Driving Anger Scale (DAS)

measures six aspects of driving anger: hostile gestures, police presence, illegal driving, slow driving, discourtesy, and traffic obstructions. Situations often encountered whilst driving are described, with respondents rating on a scale from 1 (not at all) to 5 (very much) how angered they would feel as a result of the situation. A higher score is reflective of higher trait driving anger. The long form has 33 items, and the short form has 14 items.

Behaviours generally encompassed by the term 'aggressive driving' include tailgating, flashing headlights, beeping the horn, shouting at or making rude gestures towards another driver, and deliberately cutting in front of another vehicle. Research indicates that driving aggression contributes to the risk of accidents and crashes (Wickens, Mann, Ialomiteanu & Stoduto, 2015; Zhang & Chan, 2016). Several interesting theories have been posited as explanations of aggression on the road. One theory is that drivers anthropomorphise their vehicle, attributing a personality to it, which can be predictive of aggressive driving behaviours (Benfield, Szlemko & Bell, 2007). Another states that aggressive driving arises when drivers feel that their personal space/property (i.e. the vehicle) is threatened, and can be predicted by territorial markings such as bumper stickers, and attachment to the vehicle (Szlemko, Benfield, Bell, Deffenbacher & Troup, 2008). Weiner's attributional theory (2000) is a broader framework which has also been suggested as one way of explaining aggressive driving behaviour. This theory posits that behaviour is determined by affect, which is in turn determined by cognitions. This has been supported by some research (e.g. Vallieres, Vallerand, Bergeron & Mcduff, 2014; Wickens, Wiesenthal, Flora & Flett, 2011), which has found that attributing other road users' behaviour to internal, stable causes can lead to aggressive driving behaviour in response.

However, none of these theories can fully account for aggressive driving behaviour.

1.3. Individual differences in driving anger and aggression

Research indicates there are some gender differences in aspects of general anger and aggression. A meta-analytic review conducted by Archer (2004) concluded that there is no general difference in the levels of experienced anger between the sexes; but that men were more prone to risky aggressive behaviours than women (e.g. weapon use). There is partial support for gender differences in anger and aggression on the roads; González-Iglesias, Gómez-Fraguela and Luengo-Martín (2012) found that male drivers self-reported more personal physical aggressive expression than females, while Bogdan, Mairean and Havarneanu (2016) reported that females tended to self-report higher levels of driving anger than males. Further to this, Hennessy and Wiesenthal (2001) found no gender differences in mild driver aggression, though males self-reported higher levels of driver violence. However, there is also research that does not support the notion of gender differences. Deffenbacher et al. (1994) found no gender differences in DAS full scale scores, and Herrero-Fernández (2011) found no gender differences in driving anger or aggression after controlling for age.

Bogdan et al. (2016) noted in their meta-analysis that the relationship between anger (both trait and driving) and aggressive driving had an inverse relationship with age and driving experience of participants – that is, younger drivers with lower lifetime mileage were more likely to self-report higher anger and aggressive driving tendencies. It may be that aggressive driving tendencies decline with age; however, no longitudinal studies have yet been conducted in this area.

Further individual difference factors have been implicated in aggressive driving. These include moral disengagement (Swann, Lennon & Clearly, 2017); Dark Triad traits (psychopathy, narcissism, and Machiavellianism; Burtăverde, Chraif, Aniţei & Mihăilă, 2016); hostility (Beanland, Sellbom & Johnson, 2014); attributing the behaviour of other drivers to internal, stable factors (Lennon & Watson, 2015; Wickens et al., 2011); and driver vengeance (Hennessy & Wiesenthal, 2005). These relationships are not clear-cut, however, so there is more to learn.

1.4. Interventions for driving anger/aggression

One of the motivations for studying aggressive driving behaviour is the potential for developing both preventative interventions (i.e. trying to stop people becoming aggressive in the first place) and interventions to reduce the impact of aggression on the roads (i.e. trying to help people express and manage their anger/aggression in less harmful ways). Because driving anger and aggressive driving behaviours are not yet well understood, few studies have considered interventions to reduce anger and aggression on the roads.

Deffenbacher, Filetti, Lynch, Dahlen and Oetting (2002) considered the effectiveness of relaxation and cognitive-relaxation interventions for reducing driver anger. Participants in both interventions self-reported lower levels of driving anger, and lower levels of aggressive expression of driving anger, following intervention. Deffenbacher et al. (2002) also found participants self-reported increased use of adaptive/constructive ways of expressing driving anger. However, it should be noted that the sample was small (N=55), and consisted of university students, and is therefore not representative of the general driving population. Nevertheless, these findings suggest that interventions to reduce driving anger can result in reductions in driving aggression, and the use of a no-

treatment control group increases validity of the findings. Similarly, Galovski and Blanchard (2002) used a cognitive-behavioural intervention with self-referred and court-referred aggressive drivers. This study was also conducted using a small sample (N=28). Individuals self-reported lower driving anger and fewer daily aggressive driving behaviours following treatment. These gains were maintained at two-month follow-up. The use of a community sample of individuals known to have contravened driving laws increases the generalisability and clinical utility of the findings. Thus, is seems there is some utility in attempting to reduce driving anger in order to influence aggressive driving behaviours. This is supported by a meta-analysis of treatment effects for interventions addressing driving anger completed by Del Vecchio and Leary (2004), who reported large effect sizes; d=1.07 for cognitive-behavioural therapy, d=1.59 for relaxation therapy, and d=2.11 for cognitive therapy.

Given the aforementioned individual difference factors implicated in aggressive driving behaviour, it is interesting that no intervention has addressed any of these influences. Some may be amenable to treatment, such as attributional style or vengeance. The more we understand about the contributory factors to aggressive driving, the more likely it is we can prevent it or intervene.

1.5. Previous reviews

Three previous studies have used meta-analysis to consider the relationship between anger and aggressive driving behaviour (Bogdan et al., 2016; Nesbit, Conger & Conger, 2007; Zhang & Chan, 2016). Nesbit et al. (2007) found that studies utilising a driving simulator as a measure of aggressive driving consistently reported a smaller relationship than studies using a self-report questionnaire. Bogdan et al. (2016) noted a larger relationship between trait anger and aggressive driving than for driving anger, though both were of medium magnitude.

All three studies reported a moderate relationship between anger and aggressive driving (r=0.32 to r=0.39). However, in all of these studies, both general anger and driving anger were included, with the former being the majority. Since research indicates that the two types of anger are overlapping but distinct (e.g. Deffenbacher et al., 1994), the current systematic review and meta-analysis focused only on driving anger in the form of the DAS, which is at present the only validated measure of driving anger. This study is therefore considered to have a more specific focus than previous studies, and adds something novel to the literature.

2. Objectives

The aim of the current review was to draw together the existing research on the specific relationship between the Driving Anger Scale and aggressive driving behaviours. It was felt that the outcomes could indicate how preventative measures or interventions might be of use in reducing the occurrence of such behaviours; and could also highlight directions for future research.

Despite the obvious relevance of anger in relation to some aggressive and violent behaviour, and the multitude of studies investigating the link, no systematic reviews examining the relationship between the DAS and aggressive driving behaviour were identified. During the production of this review, a study was published examining the relationship between any type of anger, and aggressive driving (Bogdan et al., 2016). However, since research shows that general anger and driving anger are overlapping but distinct concepts (e.g. Deffenbacher et al., 1994), the present review was still considered a useful contribution to the literature.

3. Methods

To determine the feasibility of a systematic review in the chosen area, a scoping exercise was conducted on four databases in October 2016. The scoping searches yielded numerous results, but no systematic reviews of relevance. This indicated that the current review would be a useful contribution to the literature on aggressive driving behaviour.

3.1. Study selection

The focus of the current review was the relationship between the DAS and aggressive driving behaviour. Studies were therefore eligible for inclusion if they met all of the following pre-defined criteria: 1) a population of individuals over the age of 16 (due to the age at which individuals can drive in different areas around the world); 2) individuals completed the DAS; 3) a measure of driving aggression was included; 4) a quantitative outcome was reported for the relationship between the DAS and aggressive driving measure. Given the potential plethora of ways to measure the concept of driving aggression, strict criteria were applied that increased the validity of the included studies – see table 2.1 for further details. Reviews, opinion papers, single-case designs, and qualitative studies were excluded.

Table 2.1
Inclusion criteria

	Inclusion	Exclusion
Population	• Males and/or females • Aged 16 or over	• Individuals aged under 16
Exposure	• Completion of the DAS	• Completion of another measure of driving anger, or general anger
Outcome	• Measure of aggressive/violent behaviour in a driving context, defined as any behaviour committed with reasonable expectation of physical or psychological harm to the victim (i.e. intent need not be assessed and harm may or may not be the outcome), as measured by: o Self-report o Behaviour in a driving simulator o Crash/traffic violation including aggression o Score on validated measure of aggressive driving (e.g. DAX, DBQ, PADS, DBI, Driving Survey) • Quantitative relationship between DAS and aggressive driving reported	• Measure of potentially non-aggressive driving behaviour (e.g. risky behaviour, stress induced behaviour) • Measure of general aggression • No quantitative relationship between DAS and aggressive driving reported

3.2. Search strategy: Sources of literature and search terms

In order to include as many relevant papers as possible, and to increase the validity of the review outcome, both published and unpublished papers were sought. Four electronic databases were searched, to try and identify all relevant studies, including well-established bibliographic databases and a dissertations and

theses portal for 'grey literature' (MEDLINE 21.10.16, PsycINFO 22.10.16, ASSIA 22.10.16, ProQuest Dissertations and Theses 04.11.16). Search terms included: (anger OR angr* OR rage) AND (aggress* OR violen*) AND (psychometric* OR assess* OR test* OR measur*) AND (driving OR traffic OR vehic* OR automobile), though minor amendments were made for each database where necessary (full syntax can be found in appendix A). The initial searches produced 503 results. Reference lists of identified studies were later searched to find any further results that initial searching had missed (n=199). Articles in languages other than English were not automatically excluded, with the potential for translation.

Following identification of studies as per the above protocol, the results were refined by excluding duplicates (n=12), clearly irrelevant titles (n=376), and clearly irrelevant abstracts (n=193). The pre-defined inclusion/exclusion criteria were applied to the full text of all remaining studies (n=122), with one study reporting two samples being treated as two studies from this point forwards, leading to 63 being excluded, and 12 more were unavailable despite attempted author contact and/or interlibrary loan requests.

3.3. Quality assessment

The primary researcher assessed the quality of the remaining studies (n=47) using checklists adapted from the Critical Appraisal Skills Programme (CASP, 2017; see appendix B). Two studies were excluded based on poor study quality or poor reporting. Initial scanning of study outcomes revealed correlation to be the most commonly reported method of examining the relationship between the DAS and driving aggression. Meta-analytic techniques were deemed appropriate for studies reporting a correlation coefficient, in order to provide a quantitative outcome of the relationship in question. Thus, a further 13 studies were excluded from meta-analysis but retained for narrative review, leaving 32

studies for meta-analysis. An independent second reviewer (a Forensic Psychologist working in a secure hospital) assessed the quality of just under 20% of the remaining studies (n=6). The intra-class correlation coefficient was good, at 0.857. See figure 2.1 for a flowchart of the study selection process.

3.4. Data extraction

After quality assessment, all included studies (for both meta-analysis and narrative review) were subjected to data extraction using the form seen in appendix C. Due to time constraints, it was not possible to contact authors to request missing information.

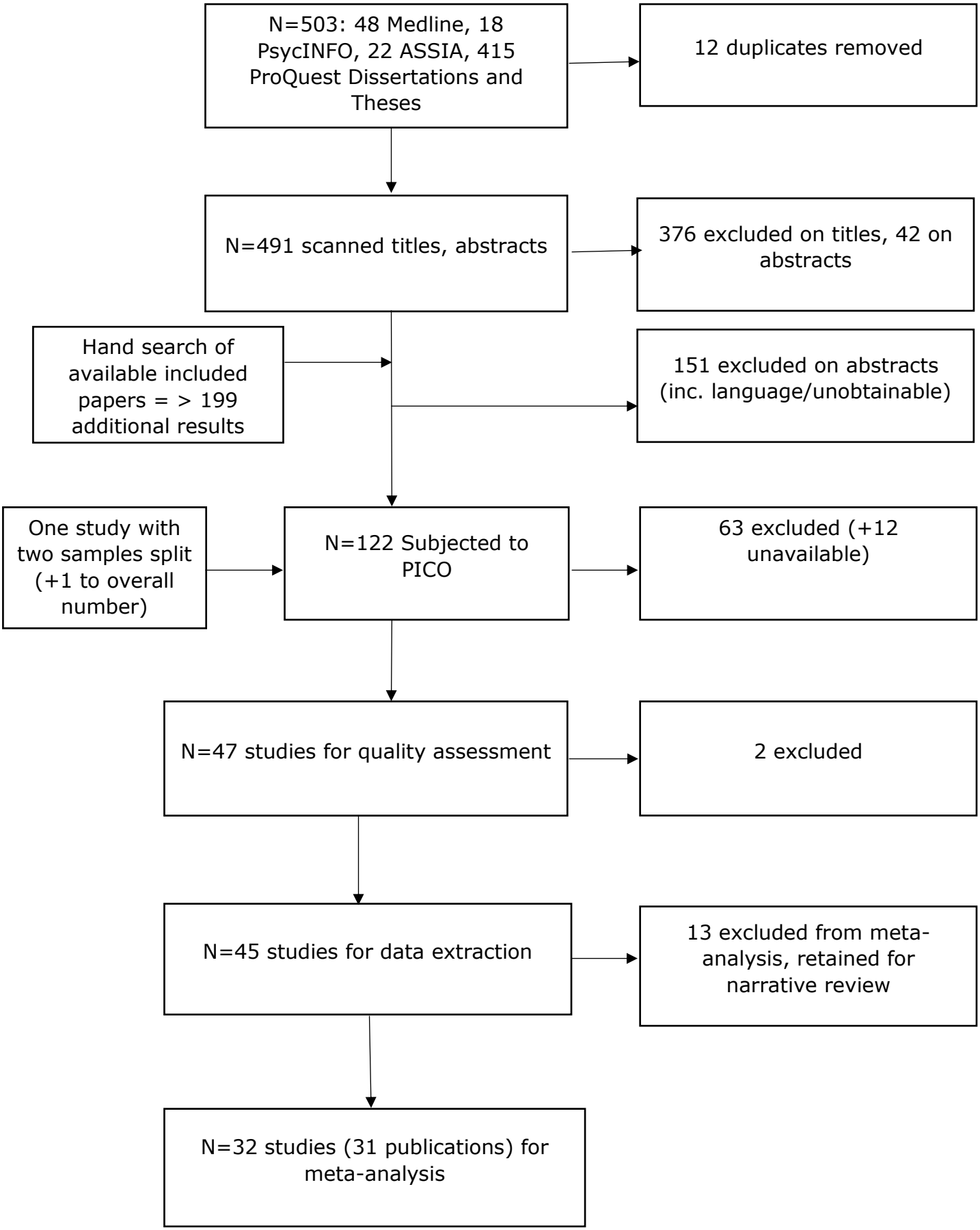

Figure 2.1: Flowchart of study selection process

4. Results

4.1. Data synthesis

The studies included in the review varied in terms of measurement of aggressive driving. However, the remainder of variables (e.g. study design, use of the DAS) were the same or similar to one another, therefore meta-analysis was considered appropriate as a means to combine overall effects of driving anger on driving aggression. For studies which were not deemed appropriate for meta-analysis (n=13), narrative synthesis was used.

4.2. Narrative synthesis

The main characteristics and outcomes of the studies not included in the meta-analysis are shown in table 2.2. Seven of the 13 studies included samples comprised mainly of females. Eight used university students (with one also using staff, and another also using general population and offenders). The majority of studies had a relatively even number of male and female participants. Six studies were conducted in the USA, five in the UK, one in Spain, and one in Turkey. All but one of the studies reported that higher DAS scores were related to higher aggressive driving outcomes. The outcome measures used were similar to those in the meta-analysed studies (self-report), though did also include two crash/accident-related outcomes, and one use of behaviour in a driving simulator. The one null outcome, reported by Underwood, Wright, Chapman and Crundall (1999), was based on near accidents and culpable accidents. On the whole, these studies support the notion of a significant positive relationship between scores on the DAS, and aggressive driving behaviours.

Table 2.2

Details of studies synthesised narratively

	Studies retained for narrative analysis	Country	Population (N; % female)	DAS form (short/long)	Outcome measure	Summary of reported outcome
1.	Deffenbacher (2003)	USA	University students (160; 50%F)	Short	DAX	High DAS=more aggressive/less adaptive driving behaviours*
2.	Deffenbacher, Deffenbacher, Lynch and Richards (2003)	USA	University students (97; 57%F)	Short	DAX	High DAS=more aggressive/less adaptive driving behaviours*
3.	Deffenbacher, Lynch, Filetti, Dahlen and Oetting (2003)	USA	University students (153; 41%F)	Short	DAX	High DAS=more aggressive/less adaptive driving behaviours*
4.	Eşiyok, Yasak and Korkusuz (2007)	Turkey	General population (220; 50%F)	Long	DAX	Positive correlation between all DAS subscales and DAX total score*
5.	Johnson and McKnight (2009)	USA	University students (49, 64%F)	Long	Simulator behaviour	Positive relationship between DAS score and aggressive driving in simulator*
6.	Lajunen and Parker (2001)	UK	General population (270; 36%F)	Long	Reactions to DAS scenarios (forced choice)	Positive correlation between DAS subscales and intensity of aggressive reactions*
7.	Lajunen, Parker and Stradling (1998)	UK	General population (270; 36%F)	Long	DBQ violations	Positive correlation between DAS subscales and aggressive violations*
8.	Maxwell, Grant and Lipkin (2005)	UK	University staff/students (245; 54%F)	UK DAS	DBI aggression	Positive correlation between DAS subscales and aggressive behaviour*

9.	Nesbit and Conger (2011)	USA	University students (98; 49%F)	Long	Intended aggression statements	High DAS predicted more intended aggression statements*
10.	Nesbit and Conger (2012)	USA	University students (130; 68%F)	Short	Driving survey	DAS predictive of aggression*
11.	Smith, Waterman and Ward (2006)	UK	University students, general population, offenders (473; 55%F)	Short	Driving Violence Inventory	DAS contributed to prediction of driving violence*
12.	Sullman, Gras, Cunill, Planes and Font-Mayolas (2007)	Spain	University staff (371; 53%F)	Long	Crash involvement	DAS contributed to prediction of crash involvement*
13.	Underwood, Chapman, Wright and Crundall (1999)	UK	General population (100; 52%F)	Long	Near accidents/culpable accidents	DAS not significantly related to accident reports

Note. DAS=Driving Anger Scale; DAX=Driving Anger Expression Inventory; DBQ=Driver Behaviour Questionnaire; DBI=Driving Behaviour Inventory
*=significant at the level of p<.05 or below

Table 2.3

Details of studies included in meta-analysis

Studies retained for meta-analysis	Country	Population (N; % female)	DAS form (short/long)	Outcome measure	Reported r
1. Beck, Daughters and Ali (2003)	USA	University students (769; 72%F)	Short	Purpose-made questionnaire (frequency of behaviours)[a]	r=.24**
2. Berdoulat, Vavassori and Sastre (2013)	France	University students/staff, public (455; 30%F)	Long	DBQ transgressions[a]	r=.315**
3. Blasius (2003)	USA	University students/staff (452; 50%F)	Long	Purpose-made questionnaire (frequency of behaviours)[a]	r=.514***
4. Brookings, DeRoo and Grimone (2008)	USA	University students (115; 72%F)	Short	PADS[c]	r=.42, p not given
5. Dahlen, Edwards, Tubré, Zyphur and Warren (2012)	USA	General population (308; 58%F)	Short	DAX total[b]	r=.39***
6. Dahlen and Ragan (2004)	USA	University students (232; 75%F)	Short	Driving Survey aggressive driving[a]	r=.42**
7. Dahlen and White (2006)	USA	University students (312; 71%F)	Short	Driving Survey aggressive driving[a]	r=.38**
8. Deffenbacher, Kemper and Richards (2007)	USA	Community college students (330; 77%F)	Long	DAX verbal aggressive expression[b]	r=.46***
9. Deffenbacher, Lynch, Deffenbacher and Oetting (2001)	USA	University students (272; 57%F)	Short	DAX verbal aggressive expression[b]	r=.34***
10. Deffenbacher, Lynch, Oetting and Swaim (2002)	USA	Community college students (290; 68%F)	Short	DAX total[b]	r=.52***
11. Deffenbacher, Lynch, Oetting and Yingling (study 2) (2001)	USA	University students (179; 66%F)	Short	Driving log[a]	r=.28**
12. Deffenbacher, White and Lynch (2004)	USA	University students (436; 50%F)	Short	Driving Survey aggressive driving[a]	r=.405***
13. Edwards, Warren, Tubré, Zyphur and Hoffner-Prillaman (2013)	USA	University students (362; 67%F)	Short	DAX total[b]	r=.52**
14. Ge, Zhang, Zhang, Zhao, Yu, Zhang and Qu (2016)	China	General population (303; 38%F)	Short	DDDI aggressive driving[a]	r=.292**
15. Herrero-Fernández (2011)	Spain	University students, researcher acquaintances (432; 69%F)	Short	DAX total[b]	r=.37***

16. Jovanović, Lipovac, Stanojević and Stanojević (2011)	Serbia	General population (260; 47%F)	UK DAS	DAX total[b]	r=.43**
17. Knee, Neighbors and Vietor (2001)	USA	University students (107; 64%F)	Long	Purpose-made questionnaire (frequency of behaviours)[a]	r=.35***
18. Li, Li, Long, Zhan and Hennessy (study 3) (2004)	China	General population (227; 12%F)	Short	DBS aggressive driving[a]	r=.371, p not given
19. Li, Yao, Jiang and Li (2014)	China	Office workers (411; 36%F)	Long	Purpose-made questionnaire (forced choice response)[c]	r=.11*
20. Moore and Dahlen (2008)	USA	University students (316; 65%F)	Short	Driving Survey aggressive driving[a]	r=.41**
21. Nesbit, Blankenship and Murray (study 1) (2012)	USA	University students (111; 57%F)	Short	Purpose-made questionnaire (frequency of behaviours)[a]	r=.38*
22. Parkinson (2001)	UK	University students (113; 62%F)	Unclear	DBI aggression[a]	r=.40***
23. Schwebel, Severson, Ball and Rizzo (2006)	USA	University students (73; 55%F)	Short	DBQ violations[a]	r=.41**
24. Stephens and Groeger (2009)	UK	University students/staff (48; 50%F)	Short	DBQ violations[a]	r=.40**
25. Stephens and Ohtsuka (2014)	Australia	General population, university students (220; 52%F)	Short	Purpose-made scenarios (hostile aggression; frequency of behaviours)[a]	r=.62***
26. Stephens and Sullman (2014)	UK	General population (551; 51%F)	Short	DAX (short form)[b]	r=.40***
27. Stephens and Sullman (2015)	UK	General population (285; 43%F)	Short	DAX total[b]	r=.57***
28. Stephens and Sullman (2015)	Eire	General population (264; 60%F)	Short	DAX total[b]	r=.52***
29. Sullman and Stephens (2013)	New Zealand	General population (213; 56%F)	Short	PADS[c]	r=.47***
30. Sullman, Stephens and Kuzu (2013)	Turkey	Taxi drivers (282; 0%F)	Short	DAX total[b]	r=.15*
31. Sullman, Stephens and Yong (2015)	Malaysia	General population (339; 43%F)	Short	DAX total[b]	r=.38***
32. Van Rooy, Rotton and Burns (2006)	USA	University students (307; %F unclear but majority)	Long	DVQ[a]	r=.75*

Note. [a]Frequency measure of aggressive driving, [b]DAX, [c]forced choice measure of aggressive driving; DAS=Driving Anger Scale; DAX=Driving Anger Expression Inventory; DBQ=Driver Behaviour Questionnaire; PADS=Propensity for Angry Driving Scale; DDDI=Dula Dangerous Driving Inventory; DBS=Driving Behaviour Survey; DBI=Driving Behaviour Inventory; DVQ=Driving Vengeance Questionnaire
*=p<.05, **=p<.01, ***p<.001

4.3. Characteristics and quality of meta-analysed studies

The main characteristics and outcomes of the studies included in the meta-analysis are shown in table 2.3. For many of the included studies, the association between the DAS and aggressive driving was not a main area of interest. Outcome measures used were variable but considered to measure aspects of the same construct (aggressive driving), either via the Driving Anger Expression Inventory (DAX; Deffenbacher et al., 2002), by a frequency based measure of aggressive driving, or a forced choice measure. Where more than one outcome measure was used, the measure that fit best with the construct of aggressive driving defined in the inclusion/exclusion criteria was chosen.

All studies were cross-sectional in nature. All 31 publications were published between 2001 and 2016, despite the initial publication of the DAS being in the 1990s (Deffenbacher et al., 1994). The majority of studies (n=25) were conducted in western countries, most of these being in the USA (n=16), with only six conducted in eastern or middle-eastern countries. Participant numbers ranged from 48 to 769, with the mean number of participants per study being 293. Selection bias was common among the assessed studies. Around two thirds of studies (*n*=21) recruited undergraduate university students or college students, five of these in conjunction with participants from another source (university staff, general population, researcher acquaintances). Nine studies recruited from the general population, one study considered office workers, and one study considered taxi drivers. Around two thirds of studies had a sample population comprised mainly of females (*n*=21), with percentage of females ranging from 51% to 77%. Where demographics were reported, the majority of participants were Caucasian. Reported ages ranged from 18-81. The short form of the DAS was used in 24 studies, the long form in six, the UK DAS in one, and it was unclear in one study

whether the short or long form was used. A variety of outcome measures were used, but these could be categorised as follows: studies utilising a measure based on respondents rating the frequency of given aggressive driving behaviours (n=17); studies utilising the DAX total aggressive expression index, or its verbal aggressive expression subscale (n=12); and studies utilising a forced choice measure of responses to potentially aggression-inducing driving situations (n=3).

4.4. Meta-analysis

Review Man statistical software (version 5.3.5, 2017) was used to meta-analyse data. In order to facilitate this, correlation coefficients were converted to z-scores. A random effects model was used to allow for differences between studies, such as sample size or outcome measure used. Heterogeneity between effect estimates was assessed with X^2 statistics (Cochran's Q) and I^2 percentages, to measure the significance of any differences and analyse the degree of variation, respectively.

Analyses produced an overall indicator of the relationship between the DAS and driving aggression, which was statistically significant (K=32, N=9374, Z=14.35, p<.00001), with a pooled correlation coefficient of 0.41 (95%CI=0.36-0.46). There was significant statistical heterogeneity between effect sizes (τ=0.03; X^2=260.00, df=31, p<.00001, I^2=88%). See figure 2.2 for a forest plot of the main effects. There was no significant change to this outcome when any one study was removed from the analysis.

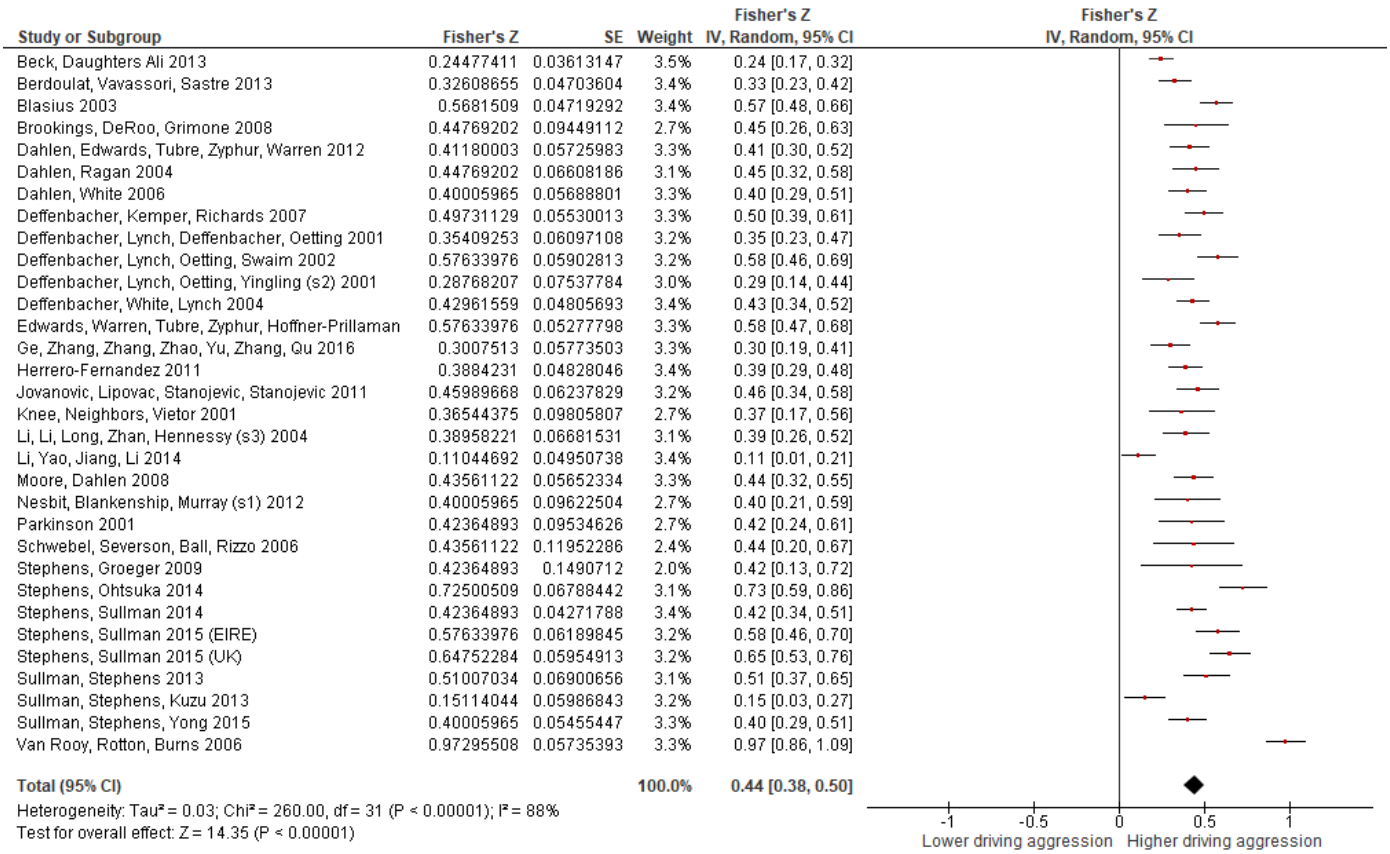

Figure 2.2: Forest plot showing effect of driving anger on driving aggression

4.5. Sensitivity analyses

Given the heterogeneity between effect sizes, a sensitivity analysis was conducted to assess whether the method of measurement of aggressive driving was the cause of this heterogeneity. Because of the number of different outcomes reported (17 in total), the aforementioned grouping was considered appropriate (full DAX/subscales, self-report frequency-based measures, forced-choice self-report measures). There were some differences between these groups, with correlation effect estimates of 0.42 (95%CI=0.36-0.49), 0.42 (95%CI=0.34-0.49), and 0.34 (95%CI=0.07-0.56), respectively. However, these differences

were not statistically significant (X^2=0.49, df=2, p=0.78, I^2=0%). See figure 2.3 for a forest plot of the subgroup analysis.

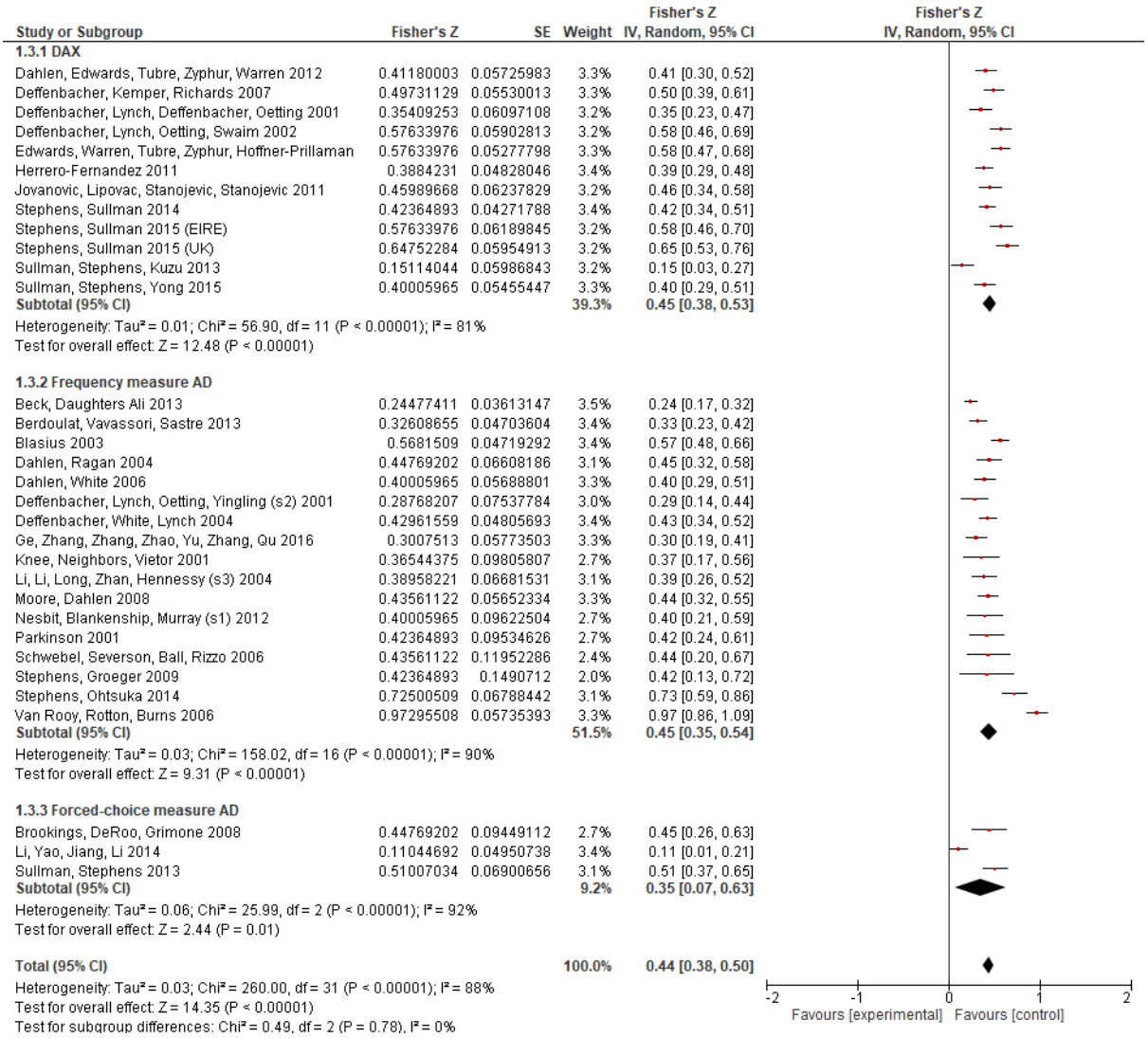

Figure 2.3: Forest plot showing subgroup analysis by driving outcome measure

4.6. Publication bias

A funnel plot of effect sizes was used to estimate the effect of publication bias on results (see figure 2.4), and showed that publication bias was not a problem in this meta-analysis.

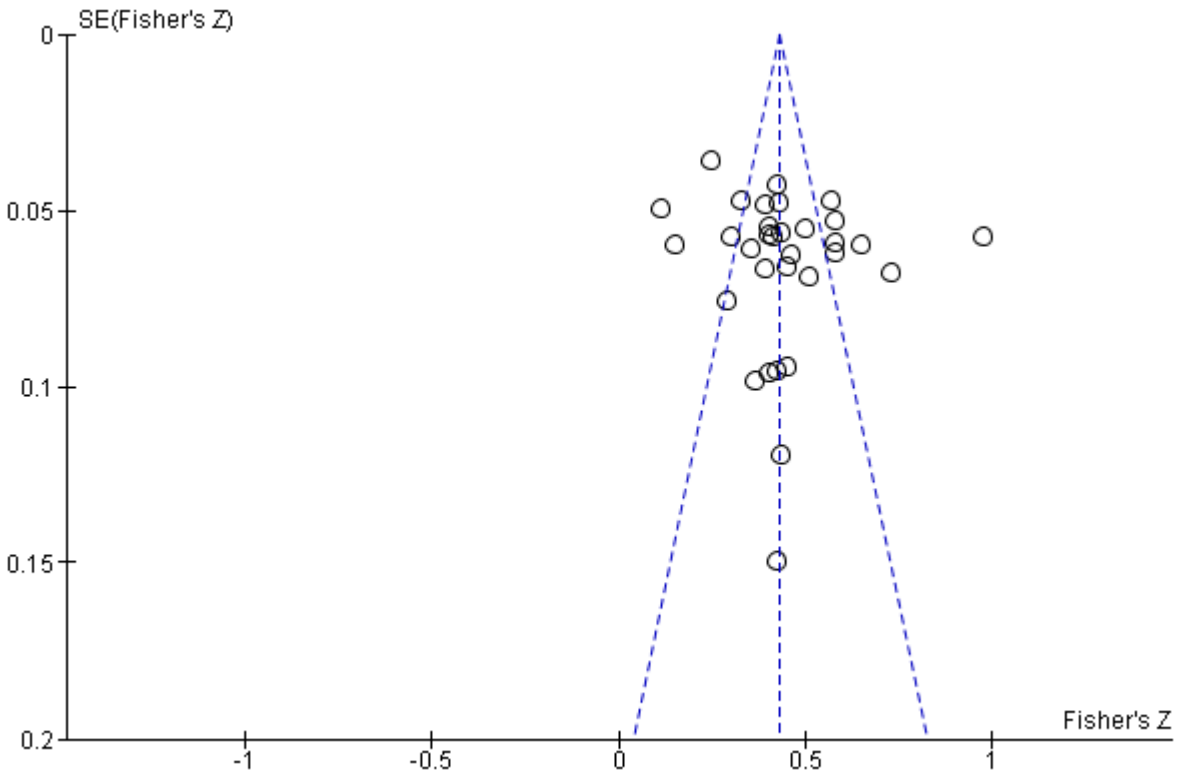

Figure 2.4: Funnel plot of effect size and standard error to show publication bias

5. Discussion

The aim of the current systematic review and meta-analysis was to investigate the relationship between a measure of driving anger (the DAS) and aggressive driving outcomes. Narrative review of 13 studies indicated a positive relationship between these variables, and meta-analysis of 32 studies provided statistical evidence of this, with a pooled correlation coefficient of r=0.41.

The results from the present study suggest that, despite varying methods of measuring aggressive driving behaviour, the DAS is reliably related to self-reported aggressive driving. This indicates that driving anger is related to, but not synonymous with or wholly predictive of, aggressive driving behaviour. Subgroup analysis showed that the method of measurement of self-reported driving aggression did not significantly affect the outcome, suggesting that both frequency

measures (including the DAX) and forced choice measures produce similar outcomes. It is important to note that the DAS and self-report measures of aggressive driving have high face validity, and may therefore be susceptible to impression management.

The current findings are similar to the outcomes found in previous meta-analyses (Bogdan et al., 2016; Nesbit et al., 2007; Zhang & Chan, 2016). It appears that the relationship remains the same, regardless of whether general or driving anger is assessed, and regardless of the outcome measure (although the vast majority are self-report questionnaires). However, the relationship is not so strong as to suggest driving anger could fully explain aggressive driving. It is likely that there are several moderating factors, and this idea deserves more research. Potential moderators include age and gender, mileage, and the individual difference factors mentioned above. Unfortunately, the majority of studies did not report enough information on such factors to allow for their inclusion in the meta-analysis.

The region in which studies included in the meta-analysis were conducted did not appear to result in differing outcomes, in contrast with previous meta-analyses (Bogdan et al., 2016). For the most part, the DAS has not been altered from its original form, regardless of where it has been used. However, a few studies have found cultural differences which necessitated alterations of the form. For example, Lajunen et al.'s (1998) factor analysis of the DAS found a three factor structure suited UK data better than the original six factor structure, with numerous items not being sufficiently angering to UK drivers to retain, or not fitting the structure. They therefore developed the 21-item UK DAS, retaining only subscales labelled as progress impeded, reckless driving, and direct hostility. Björklund (2008) noted that the translation of 'anger' into Swedish represents a

strong feeling, which may skew the distribution of response data. Instead, the translation of 'irritation' was used. This may have meant the responses were not comparable to other DAS outcomes, though the same three factor structure as in the UK DAS was found in the Swedish data. In New Zealand (Sullman, 2006), all 33 items from the original DAS were retained following factor analysis, but a four factor structure provided the best representation of the data. These differences in the structure of the DAS between countries suggest that the scale should be analysed and refined further, and also that drivers across the world are angered by different behaviours. Sârbescu's (2016) research showed that the DAS was best explained with a bifactor model, and that the data reflected a unidimensional construct. He advised that the DAS total score should be used in research, as opposed to subscale scores, since there is little specific variance in the latter after accounting for shared variance with the total scale score. More than 20 years after the DAS was developed, perhaps its structure should be revisited and revised using contemporary psychometric methods to settle the question.

The outcome measures used in the studies included in the present paper were almost all non-specific in their reporting of driving aggression. That is, it is possible that driving anger has a different relationship to different aggressive driving behaviours, such as verbal and physical aggression. It may therefore be pertinent for future research to investigate this further. In addition to this, different aspects of driving anger may predict differing outcomes. The subscales of the DAS are not always reported in studies, so this could be an avenue for further research.

The ultimate aim is to be able to prevent and/or intervene to reduce the prevalence of aggression on the roads, and its harmful effects. Further research is therefore needed to determine mediators and moderators of the relationship

between driving anger and aggressive driving, as some of these could be targets for intervention (e.g. attributions of intent, thoughts whilst driving).

6. Limitations

Although conducted following rigorous standards, there are several limitations to this review. Due to constraints on time and monetary costs, it was not possible to translate articles published in non-English language. In addition to this, the samples were biased in that they comprised mainly of young, female university students, which is not representative of the general driving population.

The outcome measures in the meta-analysed studies were psychometric questionnaires assessing aggressive driving behaviour, as opposed to actual observed behaviours. Both driving anger and driving aggression were primarily assessed via self-report in the literature this systematic review is based on. This increases the possibility that common method variance was a factor in the reported associations between the two constructs; that is, variance attributable to the measurement method rather than the constructs the measures represent. The relationship between driving anger and aggression could have been inflated by the presence of the consistency effect (respondents trying to appear rational and consistent in their self-report); or in some cases by measurement context effects such as predictor and criterion variables being measured at the same time point, in the same location, or via the same medium (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Once the literature base utilising observations of real-world driving behaviours has expanded, the review should be repeated to include these direct observations of the behaviour in question. Only studies which reported correlation coefficients were included in the meta-analysis, thus potentially influencing the validity and scope of the results; though this was done

in order to avoid estimated effect sizes if converting from another indicator. Additionally, few studies considered mediating or moderating factors, since in most cases, the relationship between the DAS and driving aggression was not the primary outcome of concern. Finally, the majority of studies were cross-sectional in design, thus no causal longitudinal relationship between DAS scores and aggressive driving outcomes can be inferred.

7. Conclusions

Based on the findings from the current systematic review and meta-analysis, there is a clear positive relationship between scores on the DAS, and self-reported aggressive driving. This relationship is strong enough that driving anger should be considered in future research on aggressive driving behaviours, but not so strong that we should stop looking for other contributory factors. More research is needed with samples representative of the general driving population – at present, samples tend to be biased due to inclusion of participants who are young, mainly students, and mainly female, therefore research outcomes may not be generalisable to the general driving population, where the interest (and the problem) really lies.

Rationale for chapter three

The systematic review highlighted the relationship between driving anger and driving aggression, and noted that the DAS is a useful tool to include in studies of aggressive driving behaviour. Chapter three presents a research study investigating the relationship between measures of personality, including the DAS, and driving aggression. A general population sample was chosen so as to ensure the outcomes were as valid as possible in their representation of everyday encounters on the road. This was only the second study to consider how the Dark Triad traits of Machiavellianism, psychopathy, and narcissism relate to aggressive driving behaviour.

CHAPTER THREE

Individual characteristics that contribute to aggressive driving behaviours

Abstract

Driving aggression is an understudied area, with conflicting information as to the origins of such behaviour. The present study investigated the role of personality as a potential contributor to aggressive driving; the study assessed driving anger, general aggression, impulsiveness, attributions of intent, and the Dark Triad traits (narcissism, psychopathy, and Machiavellianism). Members of the general community (N=168) completed an online survey battery measuring the above characteristics, and a proxy measure of aggressive driving. Regression analyses revealed that psychopathy, a history of physical aggression towards others, and the progress impeded aspect of driving anger, accounted for 50.8% of the variance in aggressive driving behaviours. The remaining variables were insignificant. These results indicate that tendencies toward expressing aggression physically, frustration at goals being impeded, and a callous, impulsive nature can predispose an individual to aggressive driving behaviours. Implications of these findings and recommendations for further research are discussed.

Introduction

There are countless studies of aggression and violent behaviour (e.g. Howells, 2004). However, relatively little attention has been given to aggression and violent behaviour in the context of driving, despite its contribution to the prevalence of accidents and road fatalities.

A 2014 survey carried out by Carwow (https://www.carwow.co.uk/news/2014-uk-road-rage-survey-results-1448) revealed that 81% of the 1000 UK drivers surveyed claimed to have been a victim of road rage (timescale unknown), 5% of these having been physically attacked. Dingus et al. (2016) found almost 90% of crashes in their US study (total N=905) were caused by driver-related factors (e.g. error, impairment, fatigue, distraction). Further to this, a UK Department for Transport report (2015) noted aggressive driving to be a contributory factor in 7% of fatal accidents and 3% of all road accidents in 2014. The American Automobile Association reports a much higher figure, with 56% of accidents from 2003-2007 thought to involve aggressive driving, most commonly speeding (AAA, 2009).

Research has indicated that individuals in forensic populations consistently perceive acts of driving aggression as less severe than their non-forensic counterparts do (Smith, Waterman & Ward, 2006). Some researchers have even advocated 'road rage' be recognised as a psychiatric disorder (e.g. Ayar, 2006). These findings highlight the importance of understanding aggressive driving to inform health education, road safety laws, and help devise interventions to reduce the likelihood of such behaviours. The majority of aggressive driving incidents go undetected by law enforcement, as perpetrators can often simply drive away from the scene. Nevertheless, in 2016, 235 people in the UK received custodial sentences for causing death by driving, and a further two for 'causing bodily harm

by furious driving' (Ministry of Justice, 2017). Such statistics are not reported with specific definitions of the terms concerned. This makes it difficult to know how closely 'furious' or 'dangerous' driving aligns with current definitions of aggressive driving.

Despite increased public and research interest in the factors contributing to driver behaviour, little is known about the reasons behind drivers' differing reactions to situations on the road. This is in part due to a lack of consensus regarding definitions of aggressive driving. Dula and Geller (2003) observed that the lack of consensus impedes information gathering and communication, with resultant difficulties in intervention and research progression. Some researchers have relied on behavioural examples (e.g. horn-honking latency, tailgating), while others have stated the behaviour must be intentional and endanger life, or must be the product of a negative emotion (e.g. anger, frustration). For the purposes of the present study, the term 'aggressive driving' refers to any behaviour committed by the driver of a vehicle with the intention of dominating the road, with potential to cause physical or psychological harm to other vehicle users. This definition was chosen in part so as to avoid the necessity for anger preceding a person's aggressive behaviour, as research suggests it is not a necessary component (e.g. in the case of instrumental aggression; Lajunen & Parker, 2001); and does not attempt to consider aggressive driving behaviours committed against pedestrians or cyclists, as this is another research focus entirely (see e.g. Fruhen & Flin, 2015).

A number of factors potentially increasing a person's propensity for aggressive driving have been identified. These include environmental aspects such as excessive heat and congested roads (Sharkin, 2004); personality characteristics such as high trait anger, high state anger, narcissism, impulsivity,

and hostility (Abdu, Shinar & Meiran 2012; Beanland, Sellbom & Johnson, 2014; Berdoulat, Vavassori & Sastre, 2013; Wickens, Mann & Wiesenthal, 2013); cognitive factors such as moral disengagement while driving (Swann, Lennon & Cleary, 2017), perceived anonymity (Ellison-Potter, Bell & Deffenbacher, 2001), attributing malign intent with a stable cause to the behaviour of other drivers (Britt & Garrity, 2006; Lennon & Watson, 2015; Wickens et al., 2013); and demographic features including male gender and younger age (Britt & Garrity, 2006; Wickens, Mann, Stoduto, Ialomiteanu & Smart, 2011). Those who score higher on measures of aggressive driving are more likely to have received speeding tickets and to have been involved in a collision (Nesbit & Conger, 2012; Stephens & Sullman, 2015). This reiterates the importance of studying the phenomenon in order to be able to intervene to prevent such incidents.

Individuals who score highly on measures of driving aggression are also likely to score highly for general aggression, indicating that aggressive tendencies are not situation-specific (Lajunen & Parker, 2001; Van Rooy, Rotton & Burns, 2006). Therefore, it is reasonable to expect that personal characteristics which contribute to the general experience and expression of aggression will also be relevant in the driving context. One such set of characteristics is the Dark Triad (DT; Paulhus & Williams, 2002), which comprises three interrelated traits: narcissism (N; motivated by ego-reinforcement and a sense of entitlement), Machiavellianism (M; callous affect, acts in pursuit of longer term goals and tries to maintain positive reputation) and psychopathy (P; callous affect, impulsive behaviour in pursuit of short term goals with little regard for how others perceive them).

Research in the general aggression/violence context has indicated that P is involved in impulsive, reactive aggression, whereas N is more related to

instrumental aggression, and tends to be involved in aggressive responses only in situations where there is a perceived threat to the individual's ego (Pailing, Boon & Egan, 2014). A slightly different relationship was proposed by Jones and Paulhus (2011), who found P to be most closely associated with dysfunctional impulsivity and poor self-regulation, e.g. distraction and inaccurate decision making; whereas N was related to functional impulsivity, e.g. enthusiasm, social engagement, and adventurousness. M was found to have no consistent relationship with either type of impulsivity. In the driving context, Edwards, Warren, Tubré, Zyphur and Hoffner-Prillaman (2013) found that N was predictive of aggressive driving over and above driving anger. To date, only one study has considered the relationship of the DT with driving aggression. Burtăverde, Chraif, Aniţei and Mihăilă (2016) found that the DT, in particular P, predicted aggressive driving outcomes even after controlling for the 'big 5' personality traits (conscientiousness, agreeableness, emotional stability, openness, and extraversion).

The involvement of impulsivity in aggressive driving has been widely considered. Bıçaksız and Özkan (2016b) conducted a systematic review of the relationship between impulsivity and driving outcomes, and concluded that impulsivity was positively related to driving anger and aggression in all but one of the studies included in their review. It has also been found that incarcerated offenders self-report higher levels of impulsivity, more convictions for driving offences, and more experiences of aggressive episodes than students or the general population (Smith et al., 2006). Indeed, impulsivity has been suggested as the most reliable factor differentiating between offenders and non-offenders (Smith et al., 2006). In the wider forensic context, evidence suggests a relationship between risky traffic behaviour and non-road related criminal behaviour including vandalism and violent crime (Junger, West & Timman, 2001).

Therefore impulsivity was considered a pertinent variable to include in the present research, particularly to investigate its contribution within, and independent of, the DT.

Lennon and Watson (2015) reported that drivers who attribute a stable, internal cause to other drivers' behaviour, such as believing the other driver is incompetent or dangerous, are more likely to behave aggressively than drivers who believe others' driving transgressions to be a mistake. However, this research was limited in that respondents were not directly asked whether they believed other drivers' behaviour to be intentional or not, relying on forced-choice answers regarding the thought most likely to enter their head in response to a given scenario.

The purpose of the current study was to better understand the potential influences of attributions of intent, impulsiveness, and the DT on aggressive responses to driving situations. The research of Lennon and Watson (2015) was extended to include specific questions regarding perceived intentionality. The research was exploratory, intended to investigate the role of the above factors, individually and collectively, in relation to driving aggression.

Method

Sample

Power analysis indicated that, for a medium effect size (0.15), 154 participants would be required in order to achieve power of 0.95. A total of 260 members of the general driving population participated in the survey. Inclusion requirements were as follows: possessing a valid driving licence; being 17 years of age or older; having driven in the UK in the past year; and being fluent in English. Participants were recruited via word of mouth, snowball sampling, social

media advertising (e.g. Facebook, LinkedIn), poster advertising in a UK university (see appendix M), and online forums/research websites (e.g. callforparticipants.com). Two individuals were excluded as they indicated they did not understand conditions of participation; as well as one who was 16 years old; and one who did not hold a valid driving licence. A further 88 participants did not pass attentional screening questions (i.e. did not follow instructions to select particular answers, thus indicating they were not paying full attention to the study), and were consequently excluded. The final sample therefore comprised 168 participants.

Design

An anonymous, cross-sectional, quantitative self-report survey design was utilised. Self-reported driving anger and driving aggression were the main outcome variables of interest. This method allowed for maximum data collection in the limited timeframe available.

Procedure

Participants were directed to an online survey tool, Bristol Online Surveys, where an information sheet detailed what the study involved and addressed anonymity/confidentiality concerns (see appendix D). Individuals consented to participation via a consent form verifying their understanding of the procedure (see appendix E, in accordance with the British Psychological Society guidelines on internet-mediated research; BPS, 2017) and proceeded to the main questionnaires (in the order presented below). Finally, a debrief sheet was presented (see appendix L). The entire survey took around 20 minutes to complete.

Measures

1. Demographic questionnaire

This assessed age, gender, level of education achieved (below GCSE/O level, GCSE/O-level, AS level, A level, Bachelor's degree, Postgraduate degree or equivalents), lifetime presence and type of psychiatric diagnosis, presence of prior convictions (specifying violent convictions), lifetime presence of difficulties with alcohol or drugs, approximate annual mileage, years licence held, primary vehicle driven and primary purpose, presence of suspension from driving in the past year (see appendix F).

2. The UK Driving Anger Scale (Deffenbacher, Oetting & Lynch, 1994; UK DAS, Lajunen, Parker & Stradling, 1998; see appendix G).

This scale was adapted from the DAS (Deffenbacher et al., 1994), to better suit a UK population. The UK DAS was included as a measure of trait driving anger. Participants rate their anger in response to 21 driving-related situations using a five-point Likert scale ranging from 1 ('none at all') to 5 ('very much'). The subscales are progress impeded (anger at having to change one's speed or direction), direct hostility (anger at another driver's aggression towards you), and reckless driving (anger at the reckless behaviour of others). The UK DAS demonstrates good internal reliability (α=0.87; Lajunen et al., 1998).

3. The Barratt Impulsiveness Scale (BIS-11, Patton, Stanford & Barratt, 1995; see appendix H).

The BIS-11 is a 30-item measure of impulsiveness. Respondents rate their agreement with statements about their tendencies on a four-point Likert scale ranging from 'rarely/never' to 'almost always/always'. Subscales measure attentional (inability to concentrate), non-planning (lack of forethought), and motor impulsivity (acting without thinking). The BIS-11 shows acceptable/good

reliabilities (α=0.59 to 0.74 for subscales, 0.83 for total) and convergent validity (Stanford et al., 2009). To improve participant comprehension, the item 'I often have extraneous thoughts when thinking' was changed to 'I often have irrelevant thoughts when thinking', due to the relative infrequency of 'extraneous' in the English language, as compared to the synonymous 'irrelevant' (ranked 29359 and 5718 of 86800, respectively, see http://www.wordcount.org).

4. The Propensity for Angry Driving Scale (PADS; DePasquale, Geller, Clarke & Littleton, 2001; see appendix I).

The PADS was included as a proxy measure of aggressive driving. Although its name suggests it is a measure of anger, the items in fact assess putative aggressive behaviour (e.g. Lennon & Watson, 2015). The 15 scenarios present potentially aggression-inducing events on the road, and respondents choose from four reactions of varying degrees of aggression. The wording of some items was altered to suit a UK demographic, and some items were dropped in accordance with Maxwell, Grant and Lipkin's (2005) findings regarding validity in a British sample. In an extension of Lennon and Watson's research (2015), anger in response to the scenarios was measured by an additional question on a five-point scale from 'not at all' to 'very much'. Perceived intentionality relating to scenarios was also assessed with a yes/no response. The PADS has demonstrated good reliability (UK PADS α=0.89; Maxwell et al., 2005; α=0.86; original PADS DePasquale et al., 2001).

5. The Short Dark Triad (SD3, Jones & Paulhus, 2014; see appendix J).

The SD3 is a measure of Dark Triad traits (narcissism, Machiavellianism, psychopathy), comprising 27 items, with agreement rated on a five-point Likert scale ranging from 'strongly agree' to 'strongly disagree'. The SD3 has

demonstrated good reliability (α=0.71, 0.77, 0.80 for N, M and P, respectively) and discriminant and convergent validity (Maples, Lamkin & Miller, 2014).

6. The Aggression Questionnaire short form (AQ-15, Buss & Warren, 2000; see appendix K).

The AQ-15 is a 15-item measure of trait aggression, with respondents rating how true statements are of them on a five-point Likert scale from 'strongly agree' to 'strongly disagree'. Subscales measure anger, physical aggression, verbal aggression, hostility, and indirect aggression. The scale shows acceptable reliability (α=0.62 to 0.80 for subscales, 0.90 for total scale; Buss & Warren, 2000).

The fact that participants could complete the study anonymously and in private was used to reduce the impact of social desirability on responses, and provides an advantage over in-person paper surveys (Dodou & deWinter, 2014); however, it was not possible to control for confounds such as misunderstanding of items or lack of appropriate attention to the study (though Lajunen & Summala, 2003, concluded that we can trust people's self-report of their driving behaviour). In order to control for the latter problem, two attentional questions were included (e.g. 'I pay attention. Please select 'strongly agree' to show you are paying attention to your answers').

The study was granted ethical approval by the University of Nottingham Faculty of Medicine and Health Sciences Research Ethics Committee (see appendix N).

Data analysis

Data were analysed using SPSS statistical software (version 21). Tests determined normal/non-normal distribution of data, and internal reliability of the

scales (Cronbach's alpha) was calculated. Correlations between measures were calculated. A multiple regression was conducted, with demographics, the SD3, the DAS, the AQ, the BIS, anger in response to PADS scenarios, and perceived intent in PADS scenarios as predictors; and PADS score as the criterion outcome variable. Entry of the predictors as separate, conceptually sequential blocks enabled the testing of the general and specific influences of these predictors on the PADS.

Results

Data screening

Data were tested for normality. The only non-normally distributed variable was AQ physical aggression, which was slightly positively skewed (skew 2.35, kurtosis 4.54). This is to be expected, given the rarity of extreme physical aggression in the general population. The remainder of the variables were normally distributed (skew <2, kurtosis <7; Kim, 2013).

Scale reliabilities for each measure were calculated, the majority showing acceptable internal reliability ($\alpha \geq 0.70$; see below).

1. Participant demographics

See table 3.1 for details on participant demographics. The final sample comprised 168 individuals, aged 18-80 ($\bar{x}$=35.03, SD=14.25). There was a roughly even split between males and females. The most frequently stated educational level was a postgraduate degree, closely followed by a bachelor's degree. Very few individuals reported ever having received a psychiatric diagnosis, having had difficulties with alcohol or drugs, or having been convicted of an offence. None reported ever having been convicted of a violent offence. Years of holding a driving licence ranged from less than one year to 56 years ($\bar{x}$=15.17,

SD=14.18). The majority of participants reported driving a car as their primary vehicle, with the primary purpose being commuting to and from work. More than half of the sample reported driving between 8 and 12 thousand miles per year. No participants reported having been suspended from driving in the past year. These demographics indicate that this sample is a very low-crime and stable professional cohort, more strongly testing effects of personality which cannot be attributable to antisocial demographics.

T-tests revealed some differences between males and females. Male participants were older than females ($\bar{x}$=38.04, SD=14.14; $\bar{x}$=32.09, SD=13.82, respectively), $t(166)=2.76$, $p=.007$. Consistent with this, males had held their driving licence for longer than females ($\bar{x}$=18.84, SD=14.17; $\bar{x}$=11.58, SD=13.33, respectively), $t(166)=3.419$, $p=.001$. Males had also received more convictions, $t(101.024)=-2.663$, $p=.009$, and had a higher annual mileage, Mann-Whitney $U=2858.00$, $Z=-2.142$, $p=.032$. Females reported a higher overall level of education, with the modal level of education completed being a postgraduate degree, whilst for men this was a bachelor's degree, Mann-Whitney $U=2606.50$, $Z=-3.060$, $p=.002$. Females were also more likely to have received a psychiatric diagnosis, $t(103.43)=2.842$, $p=.005$.

Table 3.1

Participant demographics

		N	%
Gender	Female	85	50.6
	Male	83	49.4
Highest education status achieved	Below GCSE/no qualifications	4	2.4
	GCSE/O level	11	6.5
	AS level	2	1.2
	A level	38	22.6
	Bachelor's degree	54	32.1
	Postgraduate degree	59	35.1
Lifetime prevalence of psychiatric diagnosis	Yes	11	6.5
	No	157	93.5
Lifetime offence conviction	Yes	10	6
	No	158	94
Lifetime difficulty with alcohol/drugs	Yes	6	3.6
	No	162	96.4
Main vehicle	Motorcycle/scooter	2	1.2
	Van	4	2.4
	Car	162	96.4
Primary vehicle purpose	Social/leisure	65	38.7
	Commuting	81	48.2
	Business	17	10.1
	Occupation	5	3
Annual mileage	<2000	20	11.9
	2000-4000	22	13.1
	4000-6000	17	10.1
	6000-8000	19	11.3
	8000-10000	24	14.3
	10000-12000	29	17.3
	12000-14000	10	6
	14000-16000	6	3.6
	>16000	21	12.5

2. Driving aggression

The mean score on the PADS was 29.95 (SD=10.52), which is lower than scores reported in much of the previous research (e.g. Maxwell et al., 2005). Scores were normally distributed, and the scale demonstrated good reliability, as assessed by Cronbach's alpha (α=0.87). Male and female scores were roughly equal.

3. Driving anger

The DAS total scale and subscales all had good alpha reliability (α≥0.70; see table 3.2). Females scored significantly higher than males on the reckless driving and direct hostility subscales, as well as on the total scale (see table 3.3).

Mean anger in response to PADS scenarios was 2.87 (SD=.81, range 1.27-5.00). These values are similar to those reported by Lennon and Watson (2015). The composite scale was reliable (α=0.93).

Table 3.2

Descriptives for the DAS, SD3, AQ-15 and BIS-11

	$\bar{x}$ (SD)	Range	Scale α
DAS			
Progress impeded	2.83 (.79)	1.22-5.00	0.89
Reckless driving	3.11 (.79)	1.22-4.89	0.87
Direct hostility	2.90 (1.03)	1.00-5.00	0.87
Total scale	2.96 (.69)	1.38-4.67	0.92
SD3			
Machiavellianism	3.13 (.55)	1.78-4.67	0.74
Narcissism	2.60 (.60)	1.00-4.33	0.76
Psychopathy	2.09 (.59)	1.00-4.11	0.77
AQ			
Physical	4.13 (2.40)	3.00-14.00	0.86
Verbal	6.26 (2.71)	3.00-15.00	0.84
Anger	5.77 (2.59)	3.00-14.00	0.73
Hostility	6.01 (2.84)	3.00-14.00	0.81
Indirect	5.82 (2.38)	3.00-12.00	0.61
Total	27.99 (10.11)	15.00-63.00	0.90
BIS-11			
Attentional	15.21 (3.53)	8.00-26.00	0.68
Motor	20.49 (3.50)	12.00-29.00	0.60
Non-planning	21.78 (3.94)	12.00-31.00	0.62
Total	57.48 (8.62)	38.00-86.00	0.80

Note. DAS=Driving Anger Scale; AQ=Aggression Questionnaire; BIS-11=Barratt Impulsiveness Scale

4. Dark Triad traits

There were significant gender differences for scores on M and P, with males scoring higher than females (see table 3.3), but no differences on N. See table 3.2 for overall sample scores, and alpha reliabilities. These figures are similar to prior research on the DT (Jones & Paulhus, 2014), though the gender differences we found were more pronounced than in the original validation study.

Table 3.3

Significant gender differences on the DAS, SD3, AQ-15 and BIS-11

	Male $\bar{x}$ (SD)	Female $\bar{x}$ (SD)	*t*	*p value*
DAS RD	2.91 (.74)	3.30 (.80)	*t*(166)=-3.289	*p*=.001
DAS DH	2.60 (1.04)	3.19 (.93)	*t*(166)=-3.872	*p*<.001
DAS total	2.81 (.66)	3.11 (.69)	*t*(166)=-2.881	*p*=.004
SD3 M	3.30 (.53)	2.97 (.52)	*t*(166)=4.118	*p*<.001
SD3 P	2.32 (.62)	1.87 (.47)	*t*(153)=5.354	*p*<.001
AQ Phys	4.51 (2.76)	3.76 (1.93)	*t*(146.59)=2.02	*p*=.046
AQ Verbal	6.94 (2.93)	5.59 (2.31)	*t*(155.67)=3.32	*p*=.001
BIS Motor	21.16 (4.03)	19.85 (2.76)	*t*(144.72)=2.45	*p*=.015

Note. DAS=Driving Anger Scale; PI=progress impeded; RD=reckless driving; DH=direct hostility; SD3 M=Machiavellianism; SD3 N=narcissism; SD3 P=psychopathy; AQ=Aggression Questionnaire; Phys=Physical aggression; Verbal=verbal aggression

5. Attributions of intent

The summed driver intent scale demonstrated good reliability (α=0.70). There were no gender differences. The attribution of intent score ranged from 16-30 ($\bar{x}$=24.78, SD=2.54).

6. General aggression

Refer to table 3.2 for descriptive statistics regarding the AQ. Males scored significantly higher than females on physical aggression and verbal aggression (see table 3.3). There were no other gender differences. The AQ total scale and subscales were reliable ($\alpha \geq 0.70$), aside from indirect aggression, for which alpha was questionable at 0.61.

7. Impulsiveness

Refer to table 3.2 for descriptive statistics regarding the BIS-11. Males scored significantly higher than females on motor impulsiveness (see table 3.3). There were no other gender differences. The overall scale reliability was acceptable ($\alpha \geq 0.70$), but the subscale reliabilities were questionable ($\alpha \leq 0.70$). For the attentional and non-planning impulsiveness subscales, these values were lower than in previous research (e.g. Buss & Warren, 2000).

8. Correlations with aggressive driving

Correlational analyses revealed significant positive associations between most predictor variables and PADS scores: DAS total and all subscales; AQ total and all subscales; BIS total, and attentional and non-planning subscales; anger at PADS scenarios; attribution of intent in PADS scenarios; SD3 M, N, and P. There were significant negative correlations between the following variables and PADS scores: age; years licence held; education (see table 3.4).

Table 3.4

Significant correlations between PADS score and other variables

	Correlations	
	r	*p value*
Education level	-.24	<.005
Age	-.27	<.001
Years licence held	-.22	<.005
DAS total	.44	<.001
DAS PI	.54	<.001
DAS RD	.24	<.005
DAS DH	.28	<.001
AQ total	.52	<.001
AQ physical	.58	<.001
AQ verbal	.34	<.001
AQ anger	.35	<.001
AQ hostility	.33	<.001
AQ indirect	.46	<.001
BIS total	.28	<.001
BIS attentional	.23	<.005
BIS non-planning	.30	<.001
PADS anger	.45	<.001
PADS intent	.27	<.001
SD3 Machiavellianism	.45	<.001
SD3 Narcissism	.37	<.001
SD3 Psychopathy	.50	<.001

Note. DAS=Driving Anger Scale; AQ=Aggression Questionnaire; BIS=Barratt Impulsivity Questionnaire; PADS=Propensity for Angry Driving Scale; SD3=Short Dark Triad

9. Regression of PADS score on other variables

Because there were so many significant and sizeable correlations, regression was used to refine the overlapping associations. A multiple linear regression was performed, with PADS score as the criterion outcome, and the following variables as predictors: demographics, SD3 scales, DAS subscales, AQ subscales, BIS-11 total scores, anger in response to PADS scenarios, and attributions of intent. The more stable, reliable, trait-based constructs were entered first, followed by less reliable constructs. The resulting multiple correlation was strong (R=.747) and significant, $F(24, 143) = 7.522$, p<.001, indicating that all of the entered variables accounted for 55.8% of the variance in PADS scores. Within this, each block - adding demographics, the SD3, the DAS, and the AQ in turn – was significant at p<.001, until the BIS-11 was added, indicating lack of incremental validity. Nor did the addition of PADS anger and PADS intent explain further outcome variance. In the final model, the strongest contributors to the PADS were the DAS progress impeded subscale (standardised β=.374, p<.001), AQ physical aggression (β=.279, p<.005), and SD3 P (β=.164, p=.072).

A further multiple regression was performed based on the significant contributors to the final model detailed above; see table 3.5. This included DAS progress impeded, AQ physical aggression, and SD3 P as predictors. The resulting multiple correlation was strong (R=.713) and significant, $F(3, 164) = 56.470$, p<.001. The three variables accounted for 50.8% of the variance in PADS score.

Table 3.5

Results from final regression model including DAS PI, AQ physical aggression, and SD3 P as predictors

	Standardised β (95% confidence interval)	*t*	*p value*
Block 1			
DAS PI	.357 (.241, .473)	6.081	<.001
AQ Phys	.337 (.207, .467)	5.128	<.001
SD3 P	.241 (.116, .367)	3.803	<.001

Note. DAS PI=Driving Anger Scale progress impeded; AQ Phys=Aggression Questionnaire physical aggression; SD3 P=Short Dark Triad psychopathy

Discussion

The aim of this study was to investigate the role of driving anger, attributions of intent, and the DT traits in the prediction of aggressive driving behaviour. It was found that the progress impeded aspect of driving anger, a history of physical aggression, and DT P were the best predictors of driving aggression, together explaining 50.8% of the variance in PADS scores.

One of the study aims was to extend the research of Lennon and Watson (2015) to include participants' beliefs about the perceived intentionality of drivers' behaviour. The correlation between believing that other drivers' behaviour was intentional, and self-reported driving aggression, was small but significant (r=.269, p<.001), but the relationship was insignificant in regression analyses. This is perhaps surprising, and contrasts with findings from Lennon and Watson (2015), in which individuals who predominantly attributed other drivers' behaviours to their being 'unskilled' or 'dangerous', as opposed to being committed by 'mistake', were significantly more angered by PADS scenarios, and significantly

more likely to respond aggressively. It is unclear whether this is due to other variables in the current study capturing variance associated with beliefs about intent; this is an area in need of more research, given previous research findings that internal, stable attributions are related to driving aggression (e.g. Beanland et al., 2014). Following the results of the current study, we cannot infer why participants had angry and aggressive attitudes in response to the scenarios, though there were significant positive correlations between attributions of intent and scores on general aggression, total driving anger, SD3 P and M, anger at PADS scenarios, and total driving aggression. This indicates a link between personality and attributions of intent that future research could examine. It should be noted that our measurement of attributions of intent was at a categorical level (yes/no). Further research could introduce a more dimensional measure, for example, a Likert scale. This could lead to better understanding of the role of attributions of intent in driving anger and aggression.

Previous research has found impulsivity to be a good predictor of aggressive driving behaviour (e.g. Bıçaksız and Özkan, 2016b). In our study, however, no element of impulsivity emerged as a significant predictor in regression analyses. It may be that the DT traits (in particular, P) accounted for impulsivity over and above the general measure of the BIS-11. However, it is also notable that Bıçaksız and Özkan (2016a) developed a driving-specific impulsivity scale, the Impulsive Driver Behaviour Scale (IDBS), which explained variance in driving outcomes over and above general impulsivity measures. There is already good evidence to suggest that people behave differently when controlling a vehicle than in more general situations (e.g. in relation to anger and aggression). Further research to validate the IDBS could result in a different understanding of the relationship between impulsivity and driving aggression.

Another aim of this study was to investigate the role of the DT traits in relation to driving aggression. To the authors' knowledge, this was only the second study to look into this relationship. While all three DT traits were significantly positively correlated with aggressive driving behaviour, in regression analyses when the DT was entered as a block, only P was found to be a significant predictor of self-reported aggressive driving. This is consistent with Burtăverde et al.'s (2016) findings, that dangerous driving is an antagonistic behaviour. More research is needed to investigate the relationship further.

Most research considers the influence of driving anger as a whole, rather than looking at its constituent factors. The finding that the progress impeded aspect of driving anger predicted aggressive driving outcomes in this study is important, and if supported by further research, could have direct implications for preventative measures, as well as interventions. For example, the increasing volume of vehicles – and thus traffic – on the roads can only point towards further instances of impeded progress. When individuals are learning to drive, it might therefore be sensible to teach them how to plan their driving route so that they encounter fewer vehicles, and hence their progress is impeded less. This would fit with Lajunen and Parker's (2001) suggestion that drivers might be less likely to respond negatively to anticipated than unanticipated impedance. Alternatively, driving instructors could emphasise the importance of steady efficient driving, as repeated increasing and decreasing one's speed slows everyone down. They could also focus on ensuring their student does not engage in the behaviours that cause other drivers to become angry, such as driving much slower than the speed limit.

Anger management techniques specifically targeted at cognitions regarding impeded progress may also be of use to lessen or prevent the associated anger

which can lead to aggressive behaviour. In a wider context, policy makers may consider increased funding for public transport, and wider encouragement and acceptance of cycle to work or car share schemes. In terms of intervention, more specific treatments for drivers known to have engaged in aggressive driving behaviour should be developed. At present, there is no such intervention, though a limited number of trials involving cognitive-behavioural and relaxation techniques have been conducted (e.g. Deffenbacher, Filetti, Lynch, Dahlen & Oetting, 2002; Galovski & Blanchard, 2002). Treatments based on individual needs should be the norm, as recommended in psychology in general (e.g. formulation-based; Sturmey & McMurran, 2011). Existing sentencing guidelines mean that most driving offences are dealt with by issuing fines to the offender.

Only the most serious offences, involving causing death by careless or dangerous driving, result in prison sentences of more than 2 years. Given the current overload of the prison system (69% of UK prisons were overcrowded at the end of 2016; Allen & Watson, 2017), it is unlikely that offenders sentenced to prison for lesser offences than causing death will be in prison for long enough to be considered for treatment; and besides, no current treatment protocols are specific to driving offences. Treatments are therefore sorely needed. Another possibility that emerges, but which could only be considered once the research evidence is clearer, may be controversial. Companies whose profit and reputation depend on driving abilities, such as rental companies, insurance companies, and transport providers such as taxi firms, may wish to 'screen' potential drivers based on their likelihood of engaging in aggressive driving behaviours. This could be seen as restrictive, but on the other hand, it could save money and, more importantly, save lives.

Although the contributions of this study to the literature are noteworthy, there are limitations. The PADS has been used in several studies as a measure of aggressive driving behaviour, but a critique of the scale, conducted by the first author in the latter stages of the current study, raised questions about its validity. These centred on the forced-choice nature of response options, and issues around scale development. It may therefore be prudent to replicate the current study using a better validated measure of aggressive driving, such as the Driving Anger Expression Inventory (DAX; Deffenbacher, Lynch, Oetting & Swaim, 2002). Previous research has indicated that the 'Big 5' personality factors are associated with aggressive driving outcomes (e.g. Britt & Garrity, 2006; Dahlen, Edwards, Tubré, Zyphur & Warren, 2012; Dahlen & White, 2006); however, more recent research (Burtăverde et al., 2016) suggests that the DT traits mediate these relationships. A further limitation is the use of a proxy measure of aggressive driving (the PADS), rather than real, observable driving behaviour. This is true of the majority of research in this area, but in future more efforts should be made to use the latter (e.g. driving simulators, on-road behaviour) as a more valid outcome.

The present study provides indicators for future research in this field. Being only the second study to consider the role of DT traits in relation to aggressive driving behaviour, replications are needed to ensure this finding is robust. Our sample was more representative of the general driving population than many, though individuals educated to degree level were still over-represented. Larger, fully representative studies should be the aim in order to produce results which can be generalised and have an impact on policy to make our roads safer. Given our finding that attributions of intent were not significant predictors of aggressive driving, qualitative studies may be one option for gleaning more information as to

the reasons behind people's anger and aggression on the road. For example, to expand Lennon and Watson's research (2011), in which participants' explanations of aggressive driving behaviour broadly fell into two categories: 'teaching them a lesson' (aimed to correct unskilled driving); and 'justified retaliation' (a response to perceived intentional behaviours). Though, such verbalisations could be seen simply as rationalised antagonism.

There are a number of broader issues that have yet to be addressed in the driving aggression literature. The majority of studies are cross-sectional in nature, meaning that we have little notion of whether or how driving-related anger and aggressive behaviour may change across the life course; for example, whether involvement in a car accident influences one's behaviour on the road. Anecdotal evidence would also suggest that the type of vehicle one drives may be associated with behaviour on the road, and in the research literature, Rowden, Watson, Haworth, Lennon, Shaw and Blackman (2016) found that people who drove both motorcycles and cars behaved differently depending on which vehicle they were in control of. Finally, a major consideration is the lack of consensus among researchers as to what constitutes aggressive driving behaviour (e.g. Dula & Geller, 2003). Without a clear definition, it is difficult to interpret research as meaningful, and to review current evidence. This is an important issue to address.

Overall, our findings indicate that aggressive driving behaviours are committed by individuals with a history of aggressive behaviour, psychopathic tendencies such as impulsiveness and callous affect, and anger at having their progress impeded. These variables accounted for an impressive 50.8% of aggressive driving behaviours. The common themes would seem to be disregard for others' circumstances or wellbeing, impatience, and lack of regard for

conventional legal limits. These findings are, however, far from conclusive. Further research is needed to refine our understanding of the personal characteristics of aggressive drivers, particularly studies using simulators or, better still, real driving situations. The contribution of the current study is important, but there is much work still to do to make our roads safer.

Rationale for chapter four

Thus far, the chapters in this thesis have established the nature of aggressive driving behaviour, and its personality correlates. Chapter four considers a broader problem; that of what inattentive responding to online surveys actually means. The premise for study two only arose following initial data analysis from study one. The finding that around a third of participants responded incorrectly to one or both attentional questions provides an objective test of behavioural inattention, a performance indicator of dangerous driving. The removal of these inattentive respondents, as was originally intended, is possibly counterfactual, as one could be systematically excluding a key criterion group with particularly poor driving performance. It was decided that this needed further investigation. The implications of inattentive respondents for survey research in general, and specifically in relation to driving research, are discussed.

CHAPTER FOUR

The impact of participant inattention on research into aggressive driving behaviours

Abstract

The current study considered the impact of excluding inattentive respondents in the context of outcomes of an online survey investigating personality variables and driving behaviour. In a previous study, approximately one third of a sample (N=256) of the general driving population failed to provide correct answers to one or both of the two instructional manipulation checks (IMCs) in the survey. This study included these persons as a specific cohort. The inattentive respondents differed significantly from attentive respondents in several ways, scoring higher on measures of general aggression, impulsivity, psychopathy, and driving aggression. There were also differences in which variables were significant in regression analyses predicting driving aggression scores, indicating that though the behaviour may be relevant, inattentive responding could be masking real effects. Nevertheless, a propensity for physical aggression and psychopathic tendencies were generally good predictors. The implications of these findings are discussed in relation to survey data in general, over stringent exclusion leading to loss of the sought behaviour, and with specific reference to the driving aggression literature.

Introduction

Online surveys are a popular tool in psychological research. Designed well, they can be a quick, cheap way for researchers to achieve higher participant numbers than might be possible with face to face research. The anonymity afforded by many surveys may also reduce social desirability, which can bias results if present (Joinson, 1998). However, using online surveys to collect data can also be problematic. Concerns over data integrity can arise where there is no way to confirm a participant's age, gender, language skills, and so on (British Psychological Society, 2017); this has potential to harm the field by producing invalid results. Further, the lack of effort required from participants when they can complete a survey at any time and in any place, may mean more individuals take part without due care and attention. This can mask true effects when data are analysed, increasing the chance of type I and/or type II errors (e.g. Berinsky, Margolis & Sances, 2014). Using various measures of inattentive responding, estimates of its occurrence have ranged from 1% to 43% (Curran, 2016; Maniaci & Rogge, 2014). Thus, the bias introduced into results could be considerable.

In order to combat the potential problems associated with participant inattention, Oppenheimer, Meyvis and Davidenko (2009) devised instructional manipulation checks (IMCs) or 'screeners'. These items tell participants to adhere to particular instructions when choosing a survey response. They can be embedded within other questionnaires, for example those with Likert scales, check boxes and so on. Positively, participants do not respond differently in the knowledge that they are being 'checked up on', and attrition rates are unchanged compared to surveys without the addition of IMCs (Berinsky et al., 2014). The use of IMCs can also increase statistical power to combat the effects of inattentive responding (Maniaci & Rogge, 2014). Inattentive responding is different from

socially desirable responding or impression management, which require concerted efforts from individuals. There is a negative correlation between these concepts and inattentive responding (Maniaci & Rogge, 2014). Other correlates of inattentive responding include intrinsic motivation for participation (e.g. taking part because of a genuine interest), and lower agreeableness, conscientiousness, and openness to experience (Maniaci & Rogge, 2014).

It has been hypothesised that careless or inattentive responding occurs within online surveys because the participant is distanced from the researcher, and thus feels less responsibility for their behaviour than they might face to face (Johnson, 2005). A further suggestion is that participants are less likely to attend properly if they are unmotivated to do so (e.g. Maniaci & Rogge, 2014; Oppenheimer et al., 2009). These are both difficult problems to address within online surveys, so IMCs may be attractive to researchers wishing to attenuate the influence of these issues.

For all the appeals of IMCs, their use can inadvertently introduce bias into the data. Individuals who pass checks tend to be older, female, and Caucasian (Berinsky et al., 2014; Maniaci & Rogge, 2014). The aforementioned personality correlates may also be very relevant to areas being researched, thus bias may be introduced by eliminating these participants. Of course, it is entirely possible that some attentive respondents are eliminated with the use of IMCs, and that inattentive respondents are retained by chance. However, it seems important in the pursuit of valid research outcomes to attempt to remove people who undermine data integrity. Oppenheimer et al. (2009) instructed individuals who failed an IMC to repeat it until they chose the correct response, and subsequently the differences between inattentive and attentive respondents disappeared. This

suggests that IMCs can detect a real effect of inattention without removing a source of true variance in the population.

It is not unreasonable to suppose that at least some of the respondents who fail IMCs are distracted or more distractible. In the field of driving research, distracted driving is seen as a specific form of inattention, where the driver's attention is diverted from the road to a secondary task, such as using a mobile phone or tuning the radio (National Highway Traffic Safety Administration, 2013). Distracted driving can impede traffic flow, thus causing congestion (Stavrinos et al., 2013), which may increase the likelihood of driver aggression as per the frustration-aggression hypothesis (Dollard, Doob, Miller, Mowrer & Sears, 1939). Reviews by Atchley, Tran and Salehinejad (2017), and Ferdinand and Menachemi (2014) found that the vast majority of studies reported that distraction has a negative impact on driving performance. Mind wandering, a form of distracted driving, has been found to be correlated with higher self-reports of traffic violations, accidents, and aggressive driving behaviours (Qu, Ge, Xiong, Carciofo, Zhao & Zhang, 2015). Measures of driving inattention and everyday inattention are highly correlated, suggesting individuals who are prone to everyday inattention may be more likely to be inattentive drivers (e.g. Ledesma, Montes, Poo & Lopez-Ramon, 2010; Qu, Ge, Zhang, Zhao & Zhang, 2015). In addition to this, large-scale studies have found that driver inattention (including distraction) contributes to increased odds of crash involvement (Klauer, Dingus, Neale, Sudweeks & Ramsey, 2006; Vegega, Jones & Monk, 2013). This is therefore an important area to research, both in the interest of general data collection and validity, and in the interest of preventing injuries and deaths on the roads.

The aims of the present study were to investigate the prevalence and impact of inattentive responding in an online survey regarding personality

characteristics and driving behaviours, on the grounds that in the context of a topic such as dangerous driving, the exclusion of inattentive individuals may lose important information.

Method

Sample

A total of 260 members of the general driving population participated in the survey. Inclusion requirements were as follows: possessing a valid driving licence; being 17 years of age or older; having driven in the UK in the past year; and being fluent in English. Participants were recruited via word of mouth, snowball sampling, social media advertising (e.g. Facebook, LinkedIn), poster advertising in a UK university (see appendix M), and online forums/research websites (e.g. callforparticipants.com). Two individuals were excluded as they indicated they did not understand conditions of participation; as well as one who was 16 years old; and one who did not hold a valid driving licence. Of the remaining 256 participants, 88 did not pass IMCs (i.e. did not follow instructions to select particular answers, indicating they were not paying full attention to the study), thus there were 168 participants in the attentive group, and 88 in the combined inattentive group. The data from the former group were also included in a separate study as part of the current thesis (see chapter three). The combined inattentive group could be further separated into partially attentive and inattentive respondents (n=67 and n=21, respectively), based on whether they answered one or both IMCs incorrectly.

Design

An anonymous, cross-sectional, quantitative self-report survey design was utilised. Self-reported driving aggression and participant attentiveness were the main outcome variables of interest. This method allowed for maximum data collection in the limited timeframe available.

Procedure

Participants were directed to an online survey tool, Bristol Online Surveys, where an information sheet detailed what the study involved and addressed anonymity/confidentiality concerns (see appendix D). Individuals completed a consent form to confirm their understanding of and participation in the procedure (see appendix E, in accordance with the British Psychological Society guidelines on internet-mediated research; BPS, 2017) and proceeded to the main questionnaires (in the order presented below). In two separate places within the survey, an IMC was included. These instructed participants to respond in a particular way to demonstrate their attention to the survey (e.g. 'I pay attention. Please select 'strongly agree' to show you are paying attention to your answers'). Two IMCs were chosen so as not to overload participants within an already fairly lengthy survey. Finally, a debrief sheet was presented (see appendix L). The entire survey took around 20 minutes to complete.

Measures

Please refer to the methods section of chapter three for details on the measures used.

Data analysis

Data were analysed using SPSS statistical software (version 21). Tests determined normal/non-normal distribution of data, and internal reliability of the scales (Cronbach's alpha) was calculated. Correlations between measures were calculated. Between-group differences were analysed using the appropriate parametric or non-parametric ANOVA tests. Regression allowed for inspection of the contribution of different variables to the prediction of PADS score.

Results

Data screening

All outcome variables were normally distributed (skew <2, kurtosis <7; Kim, 2013). Scale reliabilities for each measure were calculated, the majority showing acceptable internal reliability (α≥0.70; see above).

1. Participant demographics

See table 4.1 for details on participant demographics, presented for the overall sample, and the attentive, partially inattentive, and inattentive groups. The overall sample comprised 256 individuals, aged 17-80 ($\bar{x}$=34.60, SD=14.80). More than one third of participants (34%) answered one or both IMC questions incorrectly (n=67 and n=21, respectively). There was a roughly even split between males and females. The most frequently stated educational level was a bachelor's degree, closely followed by a postgraduate degree. Very few individuals reported ever having received a psychiatric diagnosis, having had difficulties with alcohol or drugs, or having been convicted of an offence. None reported ever having been convicted of a violent offence. Years of holding a driving licence ranged from less than one year to 56 years ($\bar{x}$=15.17, SD=14.78). The majority

of participants reported driving a car as their primary vehicle, with the primary purpose being commuting to and from work. The majority of the sample reported driving between 8 and 12 thousand miles per year. Three participants reported having been suspended from driving in the past year. These demographics indicate that this sample is a low-crime and stable professional cohort, more strongly testing effects of personality which cannot be attributable to antisocial demographics.

T-tests revealed some differences between males and females. Male participants were older than females ($\bar{x}$=37.19, SD=14.83; $\bar{x}$=31.75, SD=13.81, respectively), $t(254)=3.029$, $p=.003$. In fitting with this, males had held their driving licence for longer than females ($\bar{x}$=18.31, SD=14.23; $\bar{x}$=11.69, SD=13.11, respectively), $t(249)=3.816$, $p<.001$. Males were more likely to have received a conviction, $\chi^2(1)=9.275$, $p=.002$, and had a higher annual mileage, Mann-Whitney $U=6463.50$, $Z=-2.915$, $p=.004$. Females reported a higher overall level of education, Mann-Whitney $U=6250.00$, $Z=-3.370$, $p=.001$. Females were also more likely to have received a psychiatric diagnosis, $\chi^2(1)=8.056$, $p=.005$.

There were also demographic differences between the attention and inattention groups. There was a significant association between attention group and suspension from driving in the past year, $\chi^2(2)=6.231$, $p=.044$. All of the individuals who reported having been suspended from driving in the year prior to the study were from the inattentive or partially inattentive group. There was a significant association between attention group and level of education, $\chi^2(2)=14.437$, $p=.001$. Post-hoc tests showed that the partially inattentive group differed significantly from the attentive group on level of education, $U=-38.163$, $p=.001$, with the latter group tending to be more highly educated. There were no significant differences between groups on other demographic variables.

Table 4.1

Participant demographics

		Overall		Inattentive		Partially inattentive		Attentive	
		N	%	N	%	N	%	N	%
Gender	Female	122	47.7	10	47.6	27	40.3	85	50.6
	Male	134	52.3	11	52.4	40	59.7	83	49.4
Highest education status achieved	Below GCSE/no qualifications	11	4.3	1	4.8	6	9	4	2.4
	GCSE/O level	20	7.8	3	14.3	6	9	11	6.5
	AS level	10	3.9	3	14.3	5	7.5	2	1.2
	A level	60	23.4	4	19	18	26.9	38	22.6
	Bachelor's degree	80	31.3	3	14.3	23	34.3	54	32.1
	Postgraduate degree	75	29.3	7	33.3	9	13.4	59	35.1
Lifetime prevalence of psychiatric diagnosis	Yes	19	7.4	2	9.5	6	9	11	6.5
	No	237	92.6	19	90.5	61	91	157	93.5

Lifetime offence conviction	Yes	20	7.8	2	9.5	8	11.9	10	6
	No	236	92.2	19	90.5	59	88.1	158	94
Lifetime difficulty with alcohol/drugs	Yes	12	4.7	1	4.8	5	7.5	6	3.6
	No	244	95.3	20	95.2	62	92.5	162	96.4
Main vehicle	Motorcycle/scooter	2	0.8	0	0	0	0	2	1.2
	Van	6	2.3	1	4.8	1	1.5	4	2.4
	Car	244	95.3	19	90.5	63	94	162	96.4
	HGV	1	0.4	0	0	1	1.5	0	0
	Bus	3	1.2	1	4.8	2	3	0	0
Primary vehicle purpose	Social/leisure	98	38.3	8	38.1	25	37.3	65	38.7
	Commuting	125	48.8	12	57.1	32	47.8	81	48.2
	Business	26	10.2	1	4.8	8	11.9	17	10.1
	Occupation	7	2.7	0	0	2	3	5	3
Annual mileage	<2000	29	11.3	3	14.3	6	9	20	11.9
	2000-4000	34	13.3	2	9.5	10	14.9	22	13.1

	4000-6000	30	11.7	4	19	9	13.4	17	10.1
	6000-8000	32	12.5	2	9.5	11	16.4	19	11.3
	8000-10000	41	16	4	19	13	19.4	24	14.3
	10000-12000	36	14.1	3	14.3	4	6	29	17.3
	12000-14000	15	5.9	1	4.8	4	6	10	6
	14000-16000	7	2.7	1	4.8	0	0	6	3.6
	>16000	32	12.5	1	4.8	10	14.9	21	12.5
Suspension		3	1.2	1	4.8	2	3	0	0

2. Differences on outcome measures by attention group

A one-way analysis of variance showed that there were significant differences (p<.05) across attention groups, on the following variables: AQ physical, AQ verbal, AQ anger, AQ indirect hostility, AQ total score, PADS total score, BIS attentional, motor, and non-planning, and BIS total score, and SD3 psychopathy. Post-hoc tests were conducted to further investigate the nature of these differences (Tukey's HSD where variance was homogenous, Games-Howell where heterogeneous). See table 4.2 for results. Some of these effects are substantial, with inattentive and partially inattentive groups tending to score more highly than their attentive counterparts. On some variables, the inattentive group also scored significantly higher than the partially inattentive group.

Table 4.2

Significant group differences on outcome measures – three groups

	A $\bar{x}$ (SD)	P $\bar{x}$ (SD)	I $\bar{x}$ (SD)	F value	Post-hoc
AQ Physical	4.13 (2.40)	4.73 (2.80)	6.24 (3.21)	F(2, 253)=6.732, p=.001	I>A, p=.021
AQ Verbal	6.26 (2.71)	7.16 (3.01)	7.81 (2.69)	F(2, 253)=4.611 p=.011	I>A, p=.044
AQ Anger	5.77 (2.59)	6.70 (2.96)	7.76 (3.40)	F(2, 253)=6.451 p=.002	I>A, p=.042
AQ Indirect	5.82 (2.38)	6.39 (2.82)	8.10 (2.88)	F(2, 253)=7.887 p<.001	I>A, p=.005

AQ Total	28.00	31.15	37.10	F(2, 253)=7.899	I>A, *p*=.001
	(10.11)	(11.21)	(12.45)	*p*<.001	
PADS Total	29.95	31.93	38.54	F(2, 253)=6.369	I>P, *p*=.035;
	(10.52)	(10.36)	(11.85)	*p*=.002	I>A, *p*=.002
BIS	15.21	16.84	18.24	F(2, 253)=9.218	I>A, *p*=.001;
Attentional	(3.53)	(4.20)	(3.45)	*p*<.001	P>A, *p*=.007
BIS Motor	20.49	23.06	23.57	F(2, 253)=15.148	I>A, *p*=.001;
	(3.50)	(4.09)	(4.30)	*p*<.001	P>A, *p*<.001
BIS Non-	21.78	25.15	27.19	F(2, 253)=24.993	I>A, *p*<.001;
planning	(3.94)	(5.17)	(4.07)	*p*<.001	P>A, *p*<.001
BIS Total	57.48	65.04	69.00	F(2, 253)=25.763	I>A, *p*<.001;
	(8.62)	(10.73)	(9.31)	*p*<.001	P>A, *p*<.001
SD3	2.09	2.34	2.47	F(2, 253)=6.306	I>A, *p*=.025;
Psychopathy	(0.59)	(0.67)	(0.72)	*p*=.002	P>A, *p*=.014

Note. AQ=Aggression Questionnaire; PADS=Propensity for Angry Driving Scale; BIS=Barratt Impulsiveness Scale; SD3=Short Dark Triad; Attention groups are denoted as A=attentive, P=partially inattentive, I=inattentive

All of these differences held when the partially inattentive and inattentive groups were merged (combined inattentive group). See table 4.3 for details.

Table 4.3

Significant group differences on outcome measures – two groups

	Attentive $\bar{x}$ (SD)	Combined inattentive $\bar{x}$ (SD)	F value	*p value*	n^2
AQ Physical	4.13 (2.40)	5.10 (2.95)	*F*(1, 254)=7.866	*p*=.005	0.030
AQ Verbal	6.26 (2.71)	7.32 (2.94)	*F*(1, 254)=8.371	*p*=.004	0.032
AQ Anger	5.77 (2.59)	6.95 (3.08)	*F*(1, 254)=10.491	*p*=.001	0.040
AQ Indirect	5.82 (2.38)	6.80 (2.91)	*F*(1, 254)=8.367	*p*=.004	0.032
AQ Total	28.00 (10.11)	32.57 (11.73)	*F*(1, 254)=10.603	*p*=.001	0.040
PADS Total	29.95 (10.52)	33.51 (11.04)	*F*(1, 254)=6.391	*p*=.012	0.025
BIS Attentional	15.21 (3.53)	17.17 (4.06)	*F*(1, 254)=16.070	*p*<.001	0.060
BIS Motor	20.49 (3.50)	23.18 (4.12)	*F*(1, 254)=30.078	*p*<.001	0.106
BIS Non-planning	21.78 (3.94)	25.64 (4.99)	*F*(1, 254)=45.919	*p*<.001	0.153
BIS Total	57.48 (8.62)	65.99 (10.49)	*F*(1, 254)=48.253	*p*<.001	0.160
SD3 Psychopathy	2.09 (0.59)	2.38 (0.68)	*F*(1, 254)=11.979	*p*=.001	0.045

Note. AQ=Aggression Questionnaire; PADS=Propensity for Angry Driving Scale; BIS=Barratt Impulsiveness Scale; SD3=Short Dark Triad

3. Regression of PADS scores on other variables

There were numerous large, significant correlations between the majority of variables. Hence, regression was used to refine overlapping associations. Once regressions with all significant correlates had been completed, the most significant contributors to the final models were used in a further multiple regression. This was done separately for the overall sample, the attentive group, partially attentive group, inattentive group, and combined inattentive group. See table 4.4 for details of the final regression model for each group.

For the overall sample, the final model predicting total PADS score with SD3 Psychopathy, DAS progress impeded, and AQ physical aggression as predictors was strong and significant, R=.695, $F(3, 252)=78.554$, $p<.001$. This model explained 48.3% of the variance in PADS score.

The final model for the attentive group included DAS progress impeded, AQ physical aggression, and SD3 psychopathy as predictors. The resulting multiple correlation was strong ($R=.713$) and significant, $F(3, 164)=56.470$, $p<.001$. The three variables accounted for 50.8% of the variance in PADS score.

For the combined inattentive sample, the final model included AQ physical aggression, and SD3 psychopathy as predictors. The resulting multiple correlation was strong ($R=.572$) and significant, $F(2, 85)=20.710$, $p<.001$. The two variables accounted for 32.8% of the variance in PADS score.

The final model for the partially inattentive group included mileage, SD3 Psychopathy, and anger at PADS scenarios as predictors. The outcome was strong

and significant, R=.695, $F(3,63)=19.626$, $p<.001$. This model explained 48.3% of the variance in PADS score.

For the inattentive group, regression including variables with a significant correlation with PADS total score as predictors (age, licence years, DAS progress impeded and direct hostility, BIS motor impulsivity, AQ physical aggression and hostility, SD3 psychopathy) was performed. The resulting multiple correlation was strong (R=.848) and significant, $F(8, 12)=3.852$, $p=.018$. This model explained 72% of the variance in PADS score. None of these predictors contributed significantly to the model on its own, the outcome seemingly an additive effect.

Table 4.4

Results from final regression models

Sample	Standardised β (95% confidence interval)	*t*	*p value*
Overall sample			
DAS PI	.334 (.241, .427)	7.072	<.001
AQ Phys	.321 (.215, .428)	5.936	<.001
SD3 P	.281 (.176, .385)	5.300	<.001
Attentive group			
DAS PI	.357 (.241, .473)	6.081	<.001
AQ Phys	.337 (.207, .467)	5.128	<.001
SD3 P	.241 (.116, .367)	3.803	<.001
Partially inattentive group			
SD3 P	.491 (.284, .615)	5.422	<.001
PADS anger	.332 (.129, .459)	3.556	.001
Mileage	-.272 (-.442, -.083)	-2.916	.005
Inattentive group			
Licence years	-.778 (-3.638, 1.820)	-.725	.482

Age	.464 (-2.096, 3.130)	.431	.674
DAS PI	.301 (-.295, 1.017)	1.200	.253
BIS Motor	.266 (-.226, .759)	1.179	.261
AQ Phys	.215 (-.239, .626)	.976	.348
SD3 P	.103 (-.333, .533)	.505	.623
DAS DH	.101 (-.404, .625)	.468	.648
AQ Hos	-.036 (-.501, .430)	-.168	.870
Combined inattentive group			
AQ Phys	.338 (.122, .493)	3.296	.001
SD3 P	.324 (.115, .506)	3.164	.002

Note. DAS=Driving Anger Scale; AQ=Aggression Questionnaire; PADS=Propensity for Angry Driving Scale; BIS=Barratt Impulsiveness Scale; SD3 P=Psychopathy

The results of these regression analyses show that the effect of inattentiveness on the models reduced the efficacy of prediction.

Discussion

The present study investigated the prevalence of participant inattention during a survey, and whether this impacted on outcomes regarding personality measures and self-reported problematic driving behaviour. Results indicated that, when comparing individuals who did and did not pay sufficient attention, some outcomes were significantly different. The finding that approximately a third (34%) of participants answered IMC questions incorrectly is in fitting with previous findings in psychological research (Berinsky et al., 2014) though is towards the higher end of estimates for inattentive responding.

An important finding was that individuals who failed one or both of the attentional questions scored significantly higher than individuals who passed both, on several forensic-relevant measures: overall general aggression, overall driving aggression, impulsivity, and psychopathy. Excluding such persons from a forensic study seems counter-productive. Considered together, this combination of traits is suggestive of a general disregard for others' wellbeing and safety, and problems sustaining focus and considering future consequences. These are characteristics that have been implicated in driving aggression (Berdoulat, Vavassori & Sastre, 2013; Burtăverde, Chraif, Aniţei & Mihăilă, 2016; Van Rooy, Rotton & Burns, 2006). If responses were truly random, one could reasonably expect that scores would average out across the inattentive respondents, resulting in scores close to the norm for attentive respondents. The results in the current study indicate that this was not the case, thereby suggesting the presence of real differences in tendencies towards aggression, impulsivity, and psychopathy, between individuals who do and do not pay sufficient attention to online surveys.

The finding that the predictors of PADS score differed by attention group is perhaps concerning. It is possible that researchers are introducing bias into driving research by removing respondents who appear inattentive based on IMCs, as indicated by research in other contexts (Berinsky et al., 2014; Maniaci & Rogge, 2014). This is significant as regards driving aggression, because we wish to discover causal antecedents in order to reduce the incidence of aggressive driving behaviours. If research cannot identify antecedents, there is little evidence base for preventative measures or interventions. However, the same predictors were significant in the final regression models whether inattentive individuals were

excluded from the sample or not. Therefore the approach taken to the data in chapter three, to exclude inattentive respondents, still produced valid results.

It is interesting to note that the variance explained by the final regression model for inattentive respondents was so high, though this seemed to be a cumulative effect rather than there being a discernible contribution from any particular variables, which is not very useful to researchers interested in driving aggression. It is possible that individuals who really weren't paying attention throughout the study masked effects that would otherwise have been evident. Still, AQ physical aggression and SD3 psychopathy were significant contributors in the final regression models across the overall sample, the attentive group, and the combined inattentive group. This goes some way to support the notion that driving aggression has a basis in general disregard for others' safety, and the tendency to use physical aggression.

Given the nature of the survey – online, few participation requirements, no tangible incentives for participation – it is possible that careless responding was so high because participants were unmotivated to respond carefully. This would fit with Oppenheimer et al.'s (2009) finding that an unmotivated sample failed IMCs more often that a motivated sample. Participants in the current study may also have felt little to no accountability for their responses, given the anonymous nature of the survey. Again, this is consistent with previous theorising and research findings (Johnson, 2005; Oppenheimer et al., 2009). In future, researchers might consider using a method similar to Oppenheimer et al. (2009), asking respondents to repeat IMCs until they respond correctly, so as to glean the magnitude of inattentive responding whilst retaining real-world variance.

Future research should continue to investigate the potential impact of inattentive respondents on survey outcomes, but also the impact that removing them has on validity. It might be useful to try to investigate why people are inattentive or satisfice during survey research, through self-report or qualitative research. Individuals who were inattentive during the current study scored significantly higher than attentive participants on driving aggression. This may be partially explained by inattentive respondents' higher scores on measures of impulsivity, general aggression, and psychopathy. It would be useful to conduct research using a driving simulator or real-world driving observations, in order to give findings more ecological validity. There is already the suggestion that people who are inattentive in day-to-day life are more likely to be inattentive while driving (Ledesma et al., 2010; Qu et al., 2015). However, the relationship between distracted/inattentive driving and aggressive driving is unclear and deserves more research.

The current study is not without limitations. The overall sample was large, but inattentive and partially inattentive groups could have been larger to provide greater statistical power. Two IMCs were used, where perhaps more would have been appropriate, based on the length of the questionnaire. However, it was felt that two was a good number to help identify inattentive respondents whilst not relaying the idea that participants were not trusted to complete properly, which might happen with more IMCs (e.g. Meade & Craig, 2012). A further limitation is that a proxy measure of aggressive driving was used. This forced-choice response format may not reflect how individuals would truly act in a given situation on the road.

Based on the findings from the current study, inattentive responding could be a big problem in online research generally, as well as for research into personality and driving behaviours. Inattentive individuals scored higher on measures of traits which together are suggestive of a tendency to disregard the rights and safety of others, to have difficulty sustaining focus, and to act without consideration of consequences. The significant predictors of driving aggression differed according to how attentive participants were, though physical aggression and psychopathy were significant in three and four out of five final regression models, respectively. Nevertheless, the regression models did not differ significantly based on whether inattentive respondents were excluded or included. No variables emerged as significant predictors of driving aggression in the individuals who answered both IMCs incorrectly, indicating that inattentive responding masked the true effects. People who struggle to maintain focus and tend to act without consideration of future consequences may be more likely to drive in a manner which puts themselves and other road users in danger. Researchers should consider the potential impact of inattentive responding on research into driving behaviour.

Rationale for chapter five

During the course of the primary research study, a number of participants either contacted me directly or commented on survey links, expressing dissatisfaction with one of the questionnaires involved – the Propensity for Angry Driving Scale (PADS; DePasquale, Geller, Clarke & Littleton, 2001). Complainants generally felt that the forced-choice response options did not allow for accurate representation of their behavioural tendencies. This, along with the fact that no published critique of the measure could be identified, made the PADS a good choice for my psychometric critique. The measures used in research as a proxy for real-world behaviours need to have good psychometric properties in order to produce valid research outcomes. Chapter five presents a critique of the PADS, including consideration of its applicability to research and clinical settings. This is intended to help researchers in their development and choice of tools.

CHAPTER FIVE

A psychometric critique of the Propensity for Angry Driving Scale

Introduction

Several measures claim to assess driving-related anger and aggressive driving (AD) behaviours. These include the Driving Anger Scale (DAS; Deffenbacher, Oetting & Lynch, 1994), the Driving Anger Expression Inventory (DAX; Deffenbacher, Lynch, Oetting & Swaim, 2002); the Driving Survey (Deffenbacher, Lynch, Oetting & Yingling, 2001); and the Driver Behaviour Questionnaire (DBQ; Reason, Manstead, Stradling, Baxter & Campbell, 1990). The Propensity for Angry Driving Scale (DePasquale, Geller, Clarke & Littleton, 2001) was designed as a measure of propensity to become angered while driving and to subsequently engage in hostile behaviours. Given the distinction between anger (an emotional state) and aggression (a behaviour), the PADS is considered by the current author to be a measure of driving-related aggression, as its items refer solely to behaviours.

As of yet, no psychometric critique exists considering the PADS; the present paper aims to fill this gap in the literature. An overview of the scale will be provided, followed by consideration of its psychometric properties. Practical implications, limitations, and avenues for further research will also be discussed.

Overview of the PADS

The PADS was developed as a measure of propensity to become angered while driving and to subsequently engage in hostile behaviours. Table 5.1 presents

information on the populations on which the PADS was developed, as well as further studies utilising the PADS which are referred to throughout this critique. DePasquale et al. (2001) identified explicitly forensic motivations for development, including identifying drivers who might benefit from intervention to address their "road rage" behaviours (DePasquale et al., 2001). The reading level required to complete the measure is not reported. The PADS has been adapted for use in the UK (Maxwell, Grant, & Lipkin, 2005) and Australia (Aus-PADS; Leal & Pachana, 2008), and more recently has been translated into Swedish (Teräsvirta, 2011).

The PADS is a self-report questionnaire consisting of 19 potentially anger-provoking hypothetical scenarios, from which respondents select one of four possible response options, varying in their degree of aggression. See appendix O for an example item from the PADS.

Each of the potential behavioural responses has a weighting between 1 (very mild) and 7 (very extreme), which are tabulated in the original paper (DePasquale et al., 2001). The higher an individual's score, the more propensity for angry driving they are deemed to display – the outcome is regarded as continuous rather than providing categorical representation of, for example, high or low propensity to become angry whilst driving. Therefore, scores can only be described in terms of their proximity to the normative score. The limited scope for comparison in interpretation is a current limitation of the PADS.

Table 5.1

Demographic information and reported alpha reliabilities from studies utilising the PADS

Authors	N	Age	Population and location	Gender	PADS α
DePasquale et al. (2001) ⇨ Study 1 (scoring development)	51	$\bar{x}$ 19, range 18-42	UG university students, USA	29.4% male	-
⇨ Study 2 (factor analysis)	318	$\bar{x}$ 42, range 22-67	Safety professionals/industrial employees, USA	59.4% male	-
⇨ Study 3 (test-retest reliability)	38	$\bar{x}$ 20, range 17-34	UG psychology students, USA	36.8% male	-
⇨ Study 4 (validity)	96	$\bar{x}$ 18, range 17-54	UG psychology students, USA	42.7% male	0.89
Bailey et al. (2016)	280	$\bar{x}$ 34, range 17-73	University staff/students/ affiliated, Australia	51.4% male	0.84
Brookings et al. (2008)	115	$\bar{x}$ 20.7, range	UG psychology students, USA	27.8% male	-
Dahlen & Ragan (2004)	232	Median 19	UG psychology students, USA	25% male	0.85
Dula & Ballard (2003)	119	$\bar{x}$ 19.7, range 18-36	UG psychology students, USA	46% male	-
Dula et al. (2010)	1121	$\bar{x}$ 21.34, range 17-55	University students, USA	32.6% male	0.81

Leal & Pachana (2008) ⇨ Study 1 (scoring/ responses)	33	$\bar{x}$ 23.97, range 17-56	UG psychology students, Australia (adapted PADS, additional response options)	27% male	-
⇨ Study 2 (factor analysis/ norms)	439	$\bar{x}$ 26.76, range 17-66	University staff/students, Australia (19-item Aus-PADS=>15 items)	32% male	0.82
Leal & Pachana (2009)	172	$\bar{x}$ 21.52, range 17-48	UG psychology students, Australia (15-item Aus-PADS)	37% male	0.85, 0.87
Lennon & Watson (2015)	294	$\bar{x}$ 34.3, range 16-64	General population, Australia (12-item Aus-PADS=>11 items)	39% male	-
Maxwell et al. (2005)	245	$\bar{x}$ 32.44, range 21-67	University staff/students, Britain (15-item PADS)	46.5% male	0.86
Sullman & Stephens (2013)	213	$\bar{x}$ 43.96, range 17-80	General population, New Zealand	43.7% male	0.80
Teräsvirta (2011)	210	$\bar{x}$ 34.9, range 18-72	General population, Sweden (17-item PADS translated)	39.5% male	0.80

Note. $\bar{x}$ = mean; UG = undergraduate

Normative data

Normative information is extremely important when considering the suitability of a measure for a given individual or population. Two particular sample variables are important – size, and representativeness (Kline, 2013). Normative

data for the PADS was collected in study four of DePasquale et al., 2001 (see table 5.1). A significant correlation between PADS score and gender was reported (r=.30); however, the direction of this relationship was not specified, and normative data was not separated by gender. Further discussion of gender in relation to the PADS ensues later in this paper. The minimum sample size of 500 recommended by Kline (2013) to reduce standard error was not met. In addition to this, the majority of US, Western, and certainly global citizens, do not have an undergraduate education (OECD, 2016). Hence the norms may not be generalisable to other populations. Selection bias was therefore present in the development of the tool. The authors indicated potential for the PADS to be used in a forensic context; however, the normative information provided seems not to fit this aim, until the necessary validation work has been done. Caution should be exercised by anyone wishing to use the PADS with a forensic population.

Psychometric properties

Reliability

Reliability is a general consideration of how consistent a measure is in assessing the desired construct, and can be measured by internal consistency and test-retest reliability.

Internal consistency reliability

Internal consistency reliability refers to correlations between items on a measure, thus providing information on whether the measure is assessing a stable construct – two items measuring the same thing should produce similar scores.

An alpha reliability coefficient of .70 or above is considered good, and high internal consistency is considered by many researchers to be essential for high validity (Kline, 2013). The PADS internal reliability coefficients are reported in table 5.1; all are excellent at 0.80 or above.

Test-retest reliability

A measure with high test-retest reliability produces the same results on repeated administration (with no intervention provided), and is thus stable over time. This is generally measured by determining the correlation between an individual's scores on different administrations. Kline (2013) suggested a gap of at least three months between administrations, to reduce the chances of individuals simply recalling and restating their first answers; and recommended that the correlation between time one and time two be r=.80 as a minimum. Four-week test-retest reliability of the PADS was reported as r=.91. This was supported by Leal and Pachana (2009), who found three-week test-retest reliability of r=.95 in their own study.

An additional point to consider regarding test-retest reliability is the age of the samples on which the PADS has been used. As in many other areas of psychological research, undergraduate students have generally been the sample for driving aggression research. This means most individuals involved have been in their late teens or early twenties (see table 5.1 for details), and the literature reports a relationship between younger age and higher AD outcomes (e.g. Lennon & Watson, 2015; Maxwell et al., 2005; Sullman & Stephens, 2013; Teräsvirta, 2011). So, it is possible that test-retest reliability coefficients would differ if the

same sample was tested at, for example, age 20, and again at age 30. Further research should investigate the stability of PADS scores over time.

Validity

Validity refers to how accurately a tool measures the desired construct. This can be assessed in various ways, as described below.

Face validity

A test is face valid if it appears to measure the intended construct. Visual inspection of the PADS scenarios reveals similar items to those in the Driving Anger Scale (DAS; Deffenbacher et al., 1994), which is the most frequently used measure of angry driving to date (Deffenbacher, Stephens & Sullman, 2016). The PADS responses clearly relate to purported aggressive behaviour in a driving context. High face validity is desirable in some senses. For example, it may increase respondent motivation to complete the measure accurately (Kline, 2013). However, being able to guess what a test is measuring also increases the chance of socially desirable responding – answering items so as to present oneself in a positive light (Paulhus, 1991). This may be particularly important in a forensic context, where individuals could be afraid of the potential consequences of certain responses, or wish to show improvement following intervention. However, Lajunen and Summala (2003), and Sullman and Taylor (2010), reported that self-report of driving behaviour is not overly susceptible to this bias.

Concurrent validity

A test possesses concurrent validity if scores correlate highly with other measures of the same construct. Table 5.2 displays reported correlations between

PADS scores and scores on other measures of aggressive and risky driving. The reported relationships support the idea that the PADS assesses a similar conceptualisation of AD to other measures.

Table 5.2

Relationship between PADS and aggressive driving outcomes

Authors	Outcome	Reported correlation (*r)*
Dahlen & Ragan (2004)	*Driving Survey*	
	-aggressive driving	.58
	-risky driving	.49
	-moving tickets	.23
	-minor accidents	.25
	DAX	
	-physically aggressive driving anger expression	.55
	-verbally aggressive driving anger expression	.41
	- using the vehicle to express driving anger	.66
	- adaptive/constructive driving anger expression	-.38
DePasquale et al. (2001)	S-R obscene gestures	.60
	S-R verbal confrontation	.52
Dula & Ballard (2003)	*3DI*	
	-aggressive driving	.76
	-risky driving	.44
	Tickets past 2 years	.22
Dula et al. (2010)	*3DI*	
	-aggressive driving	.67
	-risky driving	.56

Maxwell et al. (2005)	Driving-related verbal disputes	.52
	DBQ violations	.40
Sullman & Stephens (2013)	S-R violations	.35

Note. DAX=Driving Anger Expression Inventory; S-R=self-reported; 3DI=Dula Dangerous Driving Index; DBQ=Driver Behaviour Questionnaire; moving tickets are any tickets received whilst the vehicle is in motion, e.g. speeding, poor lane etiquette etc.

Predictive validity

Predictive validity refers to whether a measure can predict an outcome involving the same construct at some point in the future. For the PADS, this would mean future AD behaviour, which might include driving cautions and/or convictions. Table 5.2 displays reported relationships between PADS score and driving outcomes. DePasquale et al. (2001) found scores on the PADS improved predictive value for frequency of using obscene gestures while driving, and for the frequency of verbal confrontation with other drivers, over and above that explained by anger and hostility alone.

In Maxwell et al. (2005), the predictive value of the PADS for estimating the number of verbal or physical disputes related to driving experienced in the 12 months prior to participation was not shared by the UK DAS (Lajunen, Parker & Stradling, 1998), Driving Behavior Inventory (DBI; Gulian, Mathews, Glendon, Davies & Debney, 1989), DBQ (Reason et al., 1990), nor gender, annual mileage, or age, indicating that the PADS is the best predictor of these outcomes. Dula and Ballard (2003) found the PADS was unrelated to the total number of accidents

caused, or having ever caused a crash. However, it should be noted that aggressive verbalisations and behaviours will not always result in formal action (e.g. tickets, convictions), so self-report may be a better reflection of aggressive behaviours in a driving context.

Construct validity

Construct validity encompasses convergent and discriminant validity – the extent to which a measure produces predictably similar/different outcomes to related/unrelated constructs. Table 5.3 shows the convergent and discriminant validity of the PADS.

Table 5.3

Convergent/discriminant validity of the PADS

Construct	Measure	Reported correlation (*r*)	Study
General anger	STAS	.40	DePasquale et al. (2001)
		.53	Sullman & Stephens (2013)
	STAXI trait anger	.39	Dula & Ballard (2003)
	STAXI anger out	.48	Dula & Ballard (2003)
	NAI (short form)	*rho*=.29	Leal & Pachana (2009)
	BPAQ anger	.48	Brookings et al. (2008)
Hostility	BDHI	.40	DePasquale et al. (2001)
	BPAQ hostility	.31	Brookings et al. (2008)
Driving anger	DAS	.42	Brookings et al. (2008)
		.50	Dahlen & Ragan (2004)
		.47	Sullman & Stephens (2013)
General aggression	IBS (short form) - dispositional aggression	.41	Teräsvirta (2011)

	-anger expression	.32	
	-physical aggression	.35	
	-verbal aggression	.29	
	BPAQ – total	.53	Brookings et al. (2008)
	-physical aggression	.50	
	-verbal aggression	.38	
	Self-control scale	-.31	Brookings et al. (2008)
Impulsiveness	L7 impulsiveness	.28	DePasquale et al. (2001)
	L7 venturesomeness	.00	
	SSP	.16	Teräsvirta (2011)

Note. STAS=State-Trait Anger Scale (Spielberger, Jacobs, Russell & Crane, 1983); STAXI=State-Trait Anger Expression Inventory (Spielberger, 1996); BDHI=Buss-Durkee Hostility Inventory (Buss & Durkee, 1957); DAS=Driving Anger Scale; NAI=Novaco Anger Inventory (Novaco, 1975); IBS=Interpersonal Behavior Survey (Mauger & Adkinson, 1980); BPAQ=Buss-Perry Aggression Questionnaire (Buss & Perry, 1992); SSP= Swedish Universities Scales of Personality Inventory (Gustavsson et al., 2000)

As table 5.3 shows, the PADS has moderate to strong correlations with measures of general anger and the DAS. Thus it is evident that both general trait anger and trait driving anger are related to, but conceptually distinct from, AD as measured by the PADS. The relationship with the BDHI is consistent with the idea that anger and hostility constructs overlap. Similarly, moderate to strong relationships exist between the PADS and measures of general aggression. The negative relationship with the Self-control Scale supports the idea of aggression as a loss of behavioural control. The positive relationship between the PADS and impulsivity, but lack of relationship with venturesomeness, suggests that the PADS can distinguish between drivers who take calculated risks, and those who are more prone to impulsive and potentially hostile driving behaviours.

Factor analysis can also provide information on construct validity and scale structure, which is demonstrable if all items load onto one factor or several. DePasquale et al. (2001) found this to be the case for the PADS. Further research has supported this univariate notion, once some items were removed. The 15-item version tested by Maxwell et al. (2005) represented one factor, accounting for 35.72% of the variance; the 18-item version Sullman and Stephens (2013) used was also unidimensional (with one item removed due to poor fit); as was the 19-item Aus-PADS used by Leal and Pachana (2008), explaining 21.66% of the variance. These results are indicative of good construct validity (Mundfrom, Shaw & Ke, 2005).

The use of a well-educated, Western sample for scale validation may reduce the generalisability of the outcomes, given the very different driving populations, conditions, and standards across the world. For example, many countries in Asia have dirt roads and different acceptable driving behaviours – this could mean that an event experienced in the US as angering (such as another driver cutting into a parking space you have been waiting for), may not be experienced as angering elsewhere. Indeed, Lajunen, Parker and Summala (2004) noted that sounding one's horn is generally interpreted as aggressive in the UK and Scandinavia, but can be interpreted as non-aggressive in southern European countries. Even in the west, Leal and Pachana (2008) reported a general tendency for Australian individuals to rate PADS responses as more severe than their US counterparts on whom the measure was originally validated. In accordance with this, no studies have reported mean PADS scores as high as in the original study, indicating potentially poor cross-cultural validity. Leal and Pachana (2008), Maxwell et al.

(2005), and Teräsvirta, (2011) removed items from the scale due to poor factor loadings or respondents indicating an item was not relevant to their country's driving environment, resulting in two 15-item, and one 17-item scale, respectively. Three of the items removed by Leal and Pacahana (2008) and Maxwell et al. (2005) were the same. This suggests that the items may not be relevant to all cultures, and thus that the scale is not measuring a cross-culturally valid, representative construct.

Content validity

Content validity is a reflection of whether a measure considers every aspect of the construct in question. Although general aggression could be said to be a well-defined construct, AD is decidedly not (Dula & Geller, 2003). Therefore it cannot be possible to say with confidence whether the PADS considers every aspect of AD or not.

As mentioned previously, the PADS items appear similar in content to those on the DAS (Deffenbacher et al., 1994), a well-validated and popular measure of angry driving, so scenario content would seem to be valid, providing potentially anger-provoking situations as intended. Despite this, the method of item development is of concern. Individuals were provided with a set of four potential responses to given scenarios, and rated their severity on a 7-point Likert scale, ranging from *very mild* to *very extreme* (DePasquale et al., 2001, study 1; see table 5.1). The demographic makeup of the sample again demonstrates selection bias in the development stage of the scale. The female majority may have given different severity ratings to males, since research has consistently demonstrated that males are generally more directly aggressive than females (Archer, 2004).

Indeed, some research using the PADS has found that males score higher than females (Dula & Ballard, 2003; Leal & Pachana, 2008; Lennon & Watson, 2015; Maxwell et al., 2005; Teräsvirta, 2011), and so it is reasonable to assume that males scored higher than females in the original validation study, though directionality was not reported (DePasquale et al., 2001). However, other studies reported no gender differences (Dahlen & Ragan, 2004; Sullman & Stephens, 2013).

The forced-choice nature of the PADS is another limitation. For example, on one item, there is no non-aggressive response option (all include swearing or yelling); and throughout, there is an assumption that the provided scenario will induce some anger, though respondents are not asked whether this is the case. It would not be unreasonable to infer that the PADS developers conflated anger with aggression. Indeed, Brookings, DeRoo and Grimone (2008) stated that the PADS is an appropriate measure of driving aggression, not anger. Dula et al. (2010) noted the high proportion of aggressive responses available, and stated that, "while the typical PADS response choices do represent anger-based behaviors, the conceptual clarity between anger and aggression is obscured and thus sex differences appear" (pp.2055). There is a maximum of one non-aggressive response option on all items, and it is therefore unlikely that the provided non-aggressive option would apply to all respondents who would not react aggressively in the provided scenario. It could also be said that the majority of aggressive response options provided are towards the higher end of the aggressive spectrum – there is little provision for individuals who would swear under their breath but not beep their horn or yell at the other driver, for instance. Personal experience

of using the PADS in research resulted in numerous comments to the effect of the above issues from participants. Given these shortcomings, the PADS does not seem to cover every aspect of angry or aggressive driving, and construct validity may therefore be lower than is desirable.

Practical applications

The advantages of self-report measures include that respondents can take the time to consider items without feeling rushed as they might in an interview setting, and the standardised scoring. They also tend to be less time and resource intensive. However, there are also disadvantages; acquiescence bias can be a problem (the tendency to agree more than disagree with items); as can attention – if completed at the participant's leisure, there is no control for environmental distractions. Socially desirable responding has long been considered an issue with self-report measures (Paulhus, 1991). However, Lajunen and Summala (2003), and Sullman and Taylor (2010), reported that self-reported driving behaviour is not overly susceptible to dissimulation. Nevertheless, the lack of a validity scale within the PADS is a limitation.

Discussion and conclusions

This critique considered the psychometric properties of the PADS, a 19-item self-report measure of an individual's propensity to react aggressively to potentially angering situations encountered while driving. There is good evidence for the reliability of the PADS. There is also research demonstrating the expected

relationships with related constructs (e.g. general anger and aggression, impulsivity), and some utility in predicting AD outcomes. However, a fundamental flaw lies in the nature of the AD construct, which remains unclear throughout the literature. Limitations are also present in the application of the PADS to a forensic context, given the biased nature of the samples on which it has been used. Nevertheless, the PADS shows promise in the developing field of AD research.

Further research is needed to clarify the theoretical background and nature of the AD construct. Test-retest reliability of the PADS should be investigated over extended periods (i.e. months or years). Prospective studies should be undertaken to investigate whether the PADS has utility in predicting future AD behaviours, and the tool should be tested in a forensic context. This could include measuring scores of individuals known to have committed AD behaviours, and determining whether interventions designed to reduce AD behaviours result in a decrease in PADS scores. It would also be interesting to investigate whether significant events, such as a car crash, might be associated with changes in individuals' level of driving-related anger and aggression. The use of driving simulators could benefit the field.

In addition to the above recommendations, it is possible that the name of the scale should be revised, given that it is clearly measuring behaviour rather than emotion; and respondents could be asked to rate their level of anger at given scenarios. On the whole, the PADS has potential for use in the field of AD, but where possible, should be used alongside other measures of driver anger and behaviour to ensure comprehensive measurement of the relevant concepts.

CHAPTER SIX

General discussion

The aims of the present thesis were primarily exploratory, building on previous research in the field in order to fill gaps of knowledge, with a particular focusing on developing a better understanding of the personal characteristics that contribute to aggressive driving behaviour. An overarching aim was to influence thinking, and perhaps eventually policy, regarding methods for prevention of and intervention with aggressive driving, to make our roads safer. Each chapter has provided a unique contribution to the literature on aggressive driving. This final chapter will consider the findings individually and as a whole, and their implications for future research and practice.

Chapter two presented a systematic review and meta-analysis of the relationship between driving anger, as measured by the Driving Anger Scale (DAS; Deffenbacher, Oetting & Lynch, 1994), and driving aggression. Previous reviews had not focused specifically on driving anger. Strict inclusion and exclusion criteria were applied, resulting in the narrative and quantitative analysis of good quality, highly relevant studies. Publication bias did not appear to influence the outcomes. The results indicated that scores on the DAS are reliably positively related to aggressive driving. However, this result was not so strong as to suggest the two concepts are synonymous. Unfortunately, the findings are limited in their generalisability to the general driving population due to the tendency of researchers to rely on undergraduate university students, and the focus on self-report questionnaires rather than actual behaviours to measure aggressive driving behaviour. Still, the moderate correlation indicated that the DAS is certainly

relevant to self-reported aggressive driving outcomes (regardless of the measure used) and should be included in future research, with a pooled correlation of r=0.41 (95%CI=0.36-0.46). In particular, it may be of interest to consider the contribution of each subscale of the DAS to this relationship. This review should be conducted again once there is consensus on the definition of driving aggression, more use of real-world measurement of driving behaviours, and more causal (as opposed to correlational) research.

The relationship between driving anger and aggression was further investigated in the empirical studies in chapters three and four, with an online survey capturing a sample more representative of the general driving population than many before it. The results suggested that it is primarily the progress impeded aspect of driving anger that is related to driving aggression. When combined with a tendency toward physical aggression and psychopathic tendencies (i.e. together a callous disregard for the rights and safety of others, and anger at goal impedance), these traits are good predictors of aggressive driving, as measured by the PADS. However, as demonstrated in the second study, these results can be dampened if participants are not attentive.

A further aim of the empirical studies was to investigate the potential influences of attributions of intent, impulsiveness, and the Dark Triad on aggressive responses to driving situations, building upon previous research by Lennon and Watson (2015). Attributing intent to the behaviour of other drivers was significantly positively associated with self-reported driving aggression, but this relationship was not significant in multivariate analyses. Lennon and Watson's (2015) findings were therefore not replicated. However, this is only one negative

finding, so further research may prove useful, particularly with more sensitive measures of perceived intent. Previous studies have also found impulsiveness to be a good predictor of aggressive driving. It would seem that the inclusion of psychopathy as a predictor accounts for this, whilst also explaining further variance. Future research should therefore give more consideration to psychopathy when devising studies in the driving aggression area.

In chapter four, the results made it apparent that including inattentive respondents in research can have a substantial effect on outcomes. Normally, one might exclude inattentive participants, but as inattention is perhaps a behavioural marker for a less safe driver, excluding such persons could be counterproductive in a study on driving risk. The results found in chapter three were not replicated when inattentive individuals were included in analysis.

This is a problem for researchers in general, and those studying aggressive driving behaviour, as our ultimate aim is to ascertain antecedents to the behaviour in order to reduce its occurrence. However, it is also possible that inattentive individuals systematically differ from attentive individuals on measures relevant to forensic research, such as impulsivity and general aggression. There is evidence to suggest that individuals who are less attentive in daily life are also less attentive whilst driving (Ledesma et al., 2010; Qu et al., 2015). More research is therefore needed to better understand this problem, and to devise means of countering it. One suggestion is the method employed by Oppenheimer, Meyvis and Davidenko (2009), of having respondents repeat instructional manipulation checks until they pass, which could indicate the scale of inattentive responding without losing real-world variance.

Chapter five set out to critically evaluate the psychometric properties of the Propensity for Angry Driving Scale (PADS; DePasquale, Geller, Clarke & Littleton, 2001). This was the first paper to do so, including examination of properties such as reliability and validity. Part of the rationale for this critique was the protestations of individuals who participated in the empirical research, many of whom felt that the limited response options did not allow for accurate representation of their tendencies. The process by which the PADS was developed presented a problem in the first instance, with small numbers of biased samples being used to validate the scale. The forced choice nature of responses could reduce validity of outcomes, especially given the relative lack of unaggressive options. The scoring is convoluted, and since scores are continuous, there is little opportunity for understanding what constitutes 'low' or 'high' aggressive driving. In the original paper describing the PADS, the authors described their intention that the tool be used for forensic purposes; however, the population on which the PADS was normed does not fit this aim, being primarily undergraduate university students. The PADS has been used in many countries, though some researchers have altered the items, indicating that the original scale items are not all valid across cultures.

Despite these limitations, the PADS does have potential for utility. It is relatively short and easy to administer, and has good internal and test-retest reliability. The PADS also demonstrates convergent validity, suggesting a similar conceptualisation of aggressive driving to other measures. There is some evidence that the scale has predictive value in terms of real-world driving behaviours such as use of obscene gestures and physical disputes. Factor analysis has found the

PADS to be unidimensional, which is indicative of good construct validity. Revision of the scale could prove beneficial, in the first instance with a simple change in name to reflect the focus on behaviour rather than affect. There is also a need to increase the distinction between anger and aggression in the items. It may be prudent to reconsider item content and scoring, and provide more varied and representative response options.

Considering the thesis as a whole, it is apparent that further research is needed regarding aggressive driving. At present the majority of studies are based on samples of young, female, university students, who are not representative of the driving population overall. Perhaps it would also be beneficial to investigate the more extreme end of the phenomenon by conducting research with individuals known to have committed acts of aggressive driving (e.g. those who have been cautioned or convicted). Also, there is limited cross-cultural research investigating whether driving aggression is a common construct the world over. The main area of need, as mentioned throughout, is in the definition of aggressive driving behaviour; without consensus, researchers are limited in their ability to design valid studies or to interpret outcomes. In practice, we cannot effectively devise preventative measures or interventions to reduce aggressive driving if we do not know its causes.

Nevertheless, the findings presented herein can point towards preliminary development of means to reduce the incidence and impact of aggressive driving behaviour. Implications for practice are somewhat cautious, given the aforementioned gaps and validity concerns from existing research. If aggression arises from having one's progress on the road impeded, it makes sense to take

steps to prevent this; for example, by building more roads, planning alternative routes, or limiting the number of cars on the road by increased availability of public transport, cycle schemes, or car sharing. In the UK, learner drivers are taught about technique, not emotion regulation and behaviour management – perhaps more self-regulation should be taught. There is limited research indicating that cognitive behavioural and relaxation interventions can reduce driving anger and aggressive driving (Deffenbacher, Filetti, Lynch, Dahlen & Oetting, 2002; Galovski and Blanchard, 2002), so it may be sensible to teach some of the associated methods in the first instance rather than after aggression has been identified.

As regards implications for businesses for whom driving is integral to their operation, future research could lead to a form of risk assessment as they recruit drivers. Effectively, recruiters could 'screen' potential employees to assess the risk of them engaging in aggressive driving behaviours. At present this would not be practical or ethical, but could be an option for the future, and act as a money-saving and life-saving enterprise.

Going forwards, there are a number of general recommendations for research, policy, and practice, that have arisen during the course of this thesis. The first recommendation is for the field of aggressive driving research as a whole; we must agree on a definition of the behaviour that we are studying. Without consensus, it remains very difficult to synthesise results in such a way as to make use of them. Another research recommendation is that, where possible, real-world driving behaviours are the outcome of interest, rather than self-reported behaviours. Where this is not practical, driving simulators should be used. However, the limited time and funding that many researchers have access to is

acknowledged, so where self-report questionnaires are used, they should be properly validated. A related issue of validity is the selection of samples. There is a tendency to rely on small samples of well-educated individuals residing in western countries. Although valuable findings are no doubt unearthed in these samples, aggressive driving is a wider problem, and thus requires wider, more representative sampling.

This thesis represents a research journey. Each study started as a vague idea, and through intensive investigation of existing research, theory, and real-world problems, formed into the chapters described here. Limitations are described in each chapter, but generally relate to the difficulties associated with online survey research, such as data integrity and participant inattention, and the generalisability of results from surveys to real life events. If the studies were repeated, there are some things I would change. Having critiqued the PADS (DePasquale, Geller, Clarke & Littleton, 2001), it would seem this is not the most reliable or valid measure of aggressive driving available, so in future other measures might be better choices for empirical research. Although the sample was more representative of the general driving population than many in the field, more steps could perhaps have been taken to increase representativeness further.

In conclusion, the present thesis has achieved its general aim of contributing to the literature on aggressive driving, by developing current understanding of the personality characteristics associated with the behaviour. The systematic review and meta-analysis confirmed the importance of driving anger in relation to aggressive driving. The empirical research was novel in its consideration of the role of Dark Triad traits in aggressive driving, and found that

psychopathy in particular is highly relevant when measuring this behaviour. A critique of the PADS noted limitations and areas for improvement which are appropriate points for researchers to note. Overall, the research presented in this thesis has improved our knowledge of aggressive driving behaviour.

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APPENDIX A

Search terms used for each database

MEDLINE

1	exp Anger/	7086
2	angr*.mp.	4095
3	exp Aggression/	32579
4	exp Violence/	77131
5	exp Psychometrics/	62249
6	test*.mp.	3319367
7	assess*.mp.	2466653
8	measur*.mp.	2908340
9	exp Automobile Driving/	16667
10	exp Rage/	539
11	1 or 2 or 10	10116
12	3 or 4	105064
13	5 or 6 or 7 or 8	6880694
14	9 and 11 and 12 and 13	48

PsycINFO

1	**exp ANGER/**	**12152**
2	angr*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	6458
3	exp Aggressive Behavior/	135231
4	exp violence/	64738
5	exp measurement/	308562
6	exp DRIVING BEHAVIOR/	9962
7	exp motor vehicles/	3417
8	1 or 2	17073
9	3 or 4	135231
10	6 or 7	12368
11	5 and 8 and 9 and 10	18

ASSIA

(anger OR angr* OR rage) AND (aggress* OR violen*) AND (psychometric* OR assess* OR test* OR measur*) AND (driving OR traffic OR vehic* OR automobile)

ProQuest Dissertations and Theses

(((anger) AND (aggress* OR violen*) AND (psychometric* OR assess* OR measur*) AND (driving) NOT (child*)) NOT (subt.exact("womens studies" OR "religion" OR "political science" OR "school administration" OR "theology" OR "religious history" OR "secondary education" OR "academic guidance counseling" OR "educational sociology" OR "american literature" OR "higher education" OR "music" OR "geography" OR "nursing" OR "bilingual education" OR "language arts" OR "labor relations" OR "british and irish literature" OR "theater" OR "folklore" OR "film studies" OR "elementary education" OR "art history" OR "educational leadership" OR "literature" OR "motion pictures" OR "philosophy" OR "social work" OR "american studies" OR "ethnic studies" OR "management" OR "african american studies" OR "african americans" OR "rhetoric" OR "black history" OR "black studies" OR "native american studies" OR "biographies" OR "latin american history" OR "asian studies" OR "economic history" OR "glbt studies" OR "classical studies" OR "bible" OR "science history" OR "hispanic american studies" OR "latin american studies" OR "spirituality" OR "religious education" OR "canadian history" OR "art education" OR "school counseling" OR "archaeology" OR "african history" OR "physical education" OR "preschool education" OR "middle eastern history") AND yr(1930-2019))) NOT subt.exact("international relations" OR "mass media" OR "agricultural economics" OR "energy" OR "business costs" OR "information technology" OR "surgery" OR "banking" OR "computer science" OR "forestry" OR "business community" OR "information science" OR "business administration" OR "economic theory" OR "sports medicine" OR "water resource management" OR "health care management" OR "politics" OR "soil sciences" OR "communication" OR "economics" OR "mass communications" OR "journalism" OR "marketing" OR "web studies" OR "architecture" OR "medieval literature" OR "multimedia communications" OR "alternative medicine" OR "aquaculture" OR "aquatic sciences" OR "business education" OR "environmental studies" OR "fish production" OR "health care" OR "environmental science" OR "health education" OR "sustainability" OR "industrial engineering" OR

"inservice training" OR "instructional design" OR "pharmacology" OR "sanitation" OR "wildlife management" OR "accounting" OR "actors" OR "ancient civilizations" OR "ancient history" OR "animals" OR "arms control & disarmament" OR "automation" OR "biblical studies" OR "chronic illnesses" OR "citizenship" OR "civil engineering" OR "comparative" OR "comparative literature" OR "crude oil prices" OR "dance" OR "climate change" OR "dental care" OR "disability" OR "african studies")

APPENDIX B
Quality assessment proforma

Scoring: 2=yes, 1=partial, 0=no

Identifiers	Date of quality assessment	
	Authors	
	Title	
	Year of publication	
General questions	Clear/appropriate research question(s)?	
	Appropriate study methods to assess research question(s)?	
	Clearly defined population?	
	Sample size justified?	
	Participants from the same population?	
	DAS used?	
	Appropriate measure of driving aggression?	
	Appropriate data analysis method?	
	Data assumptions tested?	
	Conclusions supported by data?	
	Believable results?	
	Generalisable results?	
Additional questions for case control studies	Controls/cases from same population?	
	Participant selection detailed?	
	Cases/controls clearly differentiated?	
	Cases/controls matched?	
Total quality score		

APPENDIX C

Data extraction proforma

Identifiers	Date of data extraction	
	Authors	
	Title	
	Year of publication	
	Published?	
	Source	
General information	Study type	
	Country	
	Language	
	Ethical approval reported?	
	Funding source reported?	
	Re-verification of inclusion criteria	
	N	
Participants	Recruitment procedure	
	Participant characteristics (age, gender, ethnicity)	
	Population type/setting	
	Inclusion criteria	
	Exclusion criteria	
	Period of measurement	
	Baseline driving anger measure (DAS short/long/alternative form)	
	Who collected?	
	Comparator?	
Outcome	Outcome measure(s) used	

	Who collected?	
	Attrition rates/reasons	
Analysis/results	Power analysis?	
	Statistics used	
	Adjustment for confounding factors?	
	Missing data explained?	
	Overview of results	
	Reported effect sizes	
	Researcher conclusions	

APPENDIX D

Information Sheet

This study investigates how members of the general population react to different situations encountered when driving, and how they make sense of other drivers' actions.

The survey consists of a number of questions about your experience of driving in the UK within the past year and how you would respond/react to certain situations. All questions are answered in simple true/false terms or through a rating scale. Please answer as many of the questions as possible. If necessary, it can be saved part way through, though takes no more than 20 minutes in total to complete.

All data collected in this survey will be held anonymously and securely. No personal data enabling you to be identified is asked for or retained. If at any point before the end of the survey you wish to remove yourself from it, none of your responses will remain as part of the survey data. Laws related to academic research require completed response sets to be kept securely for 7 years and disposed of securely at the end of this period.

Please note that, once the survey is completed, your data cannot be retrieved or removed, but is anonymous.

Cookies (personal data stored by your web browser) are not used in this survey.

This research is being organised by the University of Nottingham and will be used by the primary researcher (Laura Ball) as part of an educational qualification (Doctorate in Forensic Psychology). She can be contacted at msxlb1@nottingham.ac.uk

The project is being supervised by Dr Ruth Tully, who can be contacted at ruth.tully@nottingham.ac.uk

Any complaints should be directed to the course director, Professor Vincent Egan, at vince.egan@nottingham.ac.uk

APPENDIX E

Consent form

Thank you for participating! To continue with the study, please confirm the following:

	Yes	Yes
a. I confirm that I have read and understood the information on the previous page	○	○
b. I understand that my participation is voluntary and I can end the study at any time and withdraw my data while the study is being conducted	○	○
c. I understand that my answers will be anonymized	○	○
d. I understand the overall anonymized data from this study may be used in the future for research and teaching purposes	○	○

APPENDIX F

Demographic questionnaire

This part of the survey asks for some general information about you, with questions on a range of topics which we will ask all participants to complete. Remember it cannot be used to identify you as all data is anonymous.

Note that once you have clicked on the CONTINUE button your answers are submitted and you cannot return to review or amend that page.

Are you

- Male?
- Female?

What is the highest level of education you have completed?

Please select

Below GCSE/O-level

GCSE/O-level or equivalent

AS level or equivalent

A level or equivalent

Bachelor's degree

Postgraduate degree

What is your age in years?

Have you ever received a psychiatric diagnosis?

- Yes
- No

If yes, what was the diagnosis?

Have you previously been convicted of any offence?

- Yes
- No

a Have you ever been convicted of a violent offence? (e.g. assault, battery, GBH...)

- Yes

No

b Have you ever been convicted of a violent offence in the context of driving? (e.g. assault, battery, GBH committed inside/using a vehicle, or on a roadway/in a car park)

Yes

No

Have you ever had any difficulties with alcohol or drugs?

Yes

No

Which of the following best describes your primary vehicle?

Please select

Motorcycle/scooter

Car

Van

HGV

Bus

What is your approximate annual mileage in the UK?

Please select

0-2000 miles

2000-4000 miles

4000-6000 miles

6000-8000 miles

8000-10000 miles

10000-12000 miles

12000-14000 miles

14000-16000 miles

16000 miles and above

For what purpose do you primarily use your vehicle?

Please select

Social/leisure

Commuting – travel to and from work

Business – travel for work

Driving as an occupation

How many years have you held your UK driving licence for?

Have you been suspended from driving in the last year?

Yes

No

APPENDIX G

UK DRIVING ANGER SCALE

Imagine that each situation described below was actually happening to you and rate the amount of anger that you would feel.

	None at all	A little	Some	Much	Very much
Someone in front of you does not move off straight away when the light turns to green.					
Someone is driving too fast for the road conditions.					
A pedestrian walks slowly across the middle of the street, slowing you down.					
Someone is driving too slowly in the outside lane, and holding up traffic.					
Someone is driving very close to your rear bumper.					
Someone is weaving in and out of traffic.					
Someone cuts in right in front of you on the motorway.					
Someone cuts in and takes the parking spot you have been waiting for.					
Someone is driving more slowly than is reasonable for the traffic flow.					
A slow vehicle on a winding road will not pull over and let people pass.					
Someone backs out right in front of you without looking.					
Someone runs a red light or stop sign.					
Someone coming towards you does not dim their headlights at night.					

At night someone is driving right behind you with bright lights on.					
Someone speeds up when you try to pass them.					
Someone pulls out right in front of you when there is no-one behind you.					
Someone makes an obscene gesture towards you about your driving.					
Someone beeps at you about your driving.					
Someone is driving well above the speed limit.					
Someone shouts at you about your driving.					
A cyclist is riding in the middle of the lane and slowing traffic.					

APPENDIX H

BIS-11

People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and select the appropriate response on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

	Rarely/never	Occasionally	Often	Almost always/always
I plan tasks carefully.	○	○	○	○
I do things without thinking.	○	○	○	○
I make-up my mind quickly.	○	○	○	○
I am happy-go-lucky.	○	○	○	○
I don't "pay attention".	○	○	○	○
I have "racing" thoughts.	○	○	○	○
I plan trips well ahead of time.	○	○	○	○
I am self-controlled.	○	○	○	○
I concentrate easily.	○	○	○	○
I save regularly.	○	○	○	○
I "squirm" at plays or lectures.	○	○	○	○
I am a careful thinker.	○	○	○	○
I plan for job security.	○	○	○	○
I say things without thinking.	○	○	○	○
I like to think about complex problems.	○	○	○	○
I change jobs.	○	○	○	○
I act "on impulse".	○	○	○	○

I get easily bored when solving thought problems.	○	○	○	○
I act on the spur of the moment.	○	○	○	○
I am a steady thinker.	○	○	○	○
I change residences.	○	○	○	○
I buy things on impulse.	○	○	○	○
I can only think about one thing at a time.	○	○	○	○
I change hobbies.	○	○	○	○
I spend or charge more than I earn.	○	○	○	○
I often have irrelevant thoughts when thinking.	○	○	○	○
I am more interested in the present than the future.	○	○	○	○
I am restless at the theatre or lectures.	○	○	○	○
I like puzzles.	○	○	○	○
I am future oriented.	○	○	○	○

APPENDIX I

PROPENSITY FOR ANGRY DRIVING SCALE

The following survey contains scenarios one might encounter while driving. Please read each of the scenarios carefully and then decide which of the potential responses most closely match how you would respond in that situation.

1. You are driving your car down a two-lane road. Without warning, another car pulls out in front of you from a car park. You had to brake suddenly to avoid hitting it. How do you respond?

- Let out a sigh of relief and drive on.
- Lean out your window and yell at the other driver.
- Beep your horn to let the other driver know they almost caused an accident.
- Follow the other car to its destination so you can give the driver a piece of your mind.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes
- No

2. You are driving your car down the motorway in the passing lane. You come up to a car driving much slower than you are in the passing lane. Even though you flash your lights as a signal for the other car to move over, it does not. How do you respond?

- Make an obscene gesture at the driver as you pass on the right.
- Shrug your shoulders and continue to wait for the other car to move to the side.
- Start driving right on the rear bumper of the other car and honk your horn.
- Continue flashing your high beams at the car hoping the behaviour will cause them to move to the side.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes
- No

3. You are driving on a single lane road. For no apparent reason the car in front of you is constantly braking and accelerating causing you to drive in the same manner. How do you respond?

- Honk your horn and loudly curse at the driver.
- Honk your horn and make a mean face at the driver causing the disturbance.
- Slow down a little and keep a safe distance.
- Deliberately tailgate the car and occasionally honk your horn.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes
- No

4. You are in a full car park. You see a driver leaving and you put on your indicator to signal you intend to take the parking space. As the other driver pulls out, a second driver cuts in front of you from the other side and takes the parking space. How do you respond?

- Glare angrily at the other driver as you move on to find another parking space.
- Shrug your shoulders and look for another space to park.
- Wait for the other driver to get out of the car and then scream out your window at him/her for being an inconsiderate idiot.
- Stop your car, and approach the other car to express your anger to the driver.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes

No

5. You are driving your vehicle in a traffic jam in the far left hand lane. Out of nowhere, a car comes up from behind on the shoulder and attempts to squeeze in front of you. How do you respond?

Just let the car squeeze in.

Make obscene gestures, or yell “idiot” at the other driver as you close ranks on the car in front of you to prevent the driver from cutting in front of you.

Let the car squeeze in but honk your horn to demonstrate your disapproval to the other driver.

Honk your horn and close ranks on the vehicle in front of you to prevent the car from getting in front of you.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

Yes

No

6. You are driving on the motorway when another vehicle pulls up alongside your car. You look over and see a total stranger making obscene gestures at you. How do you respond?

Ignore the other driver by looking straight ahead and minding your own business.

Look at the other driver and shake your head in disbelief, then slow down and wait for the other car to drive on.

Glare back at the driver with a menacing face.

Make obscene gestures back to the driver in the other vehicle.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

Yes

No

7. You are driving on the motorway. One of the cars in front of you keeps switching lanes preventing other cars from passing efficiently. Thus traffic is being slowed. How do you respond?

Yell obscenities in your car and honk your horn numerous times to show your displeasure.

Pull up next to the other car so that you can honk your horn and scream obscenities at the driver for blocking traffic.

Let out a sigh and slow down with the rest of the traffic.

Yell out obscenities in your car.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

Yes

No

8. You are driving on a city street. Without warning, a pedestrian suddenly runs in front of your car nearly causing you to hit him/her. How do you respond?

Do nothing except feel grateful no one was injured.

Actually stop your car and get out to yell at the pedestrian for being careless and stupid.

Yell at the pedestrian out your window telling them to watch where they are going.

Swear loudly at the pedestrian out your window telling them next time you're not going to stop.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

Yes

No

9. Your off ramp is quickly approaching. The driver next to you is driving in a manner that is preventing you from changing lanes. You may miss your exit. How do you respond?

- Honk your horn and yell out your window at the driver telling them to get out of your way.
- Hit the accelerator to get in front of the other car, yell obscenities as you pass the other car.
- Swearing under your breath, reduce your speed as necessary to make the lane change.
- Follow the car to its destination so you can yell obscenities at the other driver.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes
- No

10. You are driving on the motorway. The driver in the car in front of you throws a cup of coffee out his/her car window. The cup hits your windshield. How do you respond?

- Honk your horn and yell at the other driver from within your car.
- Speed up next to the car and make obscene gestures at the other driver.
- Shake your head in disbelief and turn on your windshield wipers.
- Speed up so that you pass the car and then throw something out your window to hit the other car.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes
- No

11. While making a left-hand turn you accidentally cut off another car. In response, the other driver follows you to the next intersection at which point he/she pulls up to your car and proceeds to yell obscenities at you until the light turns green. When the light turns green the other driver takes off in a hurry. How do you respond?

- Follow the car to the next intersection so that you can yell obscenities back.
- Sigh in relief that the whole ordeal is over.
- Get behind the car and tailgate it to the next intersection, then pull up next to the car and yell obscenities back at the other driver.
- Yell back at the other driver telling him to relax because it was an accident.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes
- No

12. You have been stuck in a traffic jam for nearly 40 minutes. While not paying attention you accidentally bump the car in front of you. The driver in the car in front of you leans out the window and swears at you very loudly. How do you respond?

- Shrug your shoulders to indicate it was not intentional.
- Intentionally ram the car again.
- Yell back at the other driver telling him to relax because it was unintentional and there is no damage.
- Give the other driver the finger and yell back.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes

No

13. You are driving on the motorway in the passing lane. You come up behind another car in the passing lane. You flash your headlights as an indicator for the other car to move over. Instead of moving over, you see the driver in the other car give you the finger and remain in the passing lane. How do you respond?

Start flashing your lights with greater frequency hoping to influence the driver to move over.

Get right on the rear bumper of the car, flash your lights, and honk your horn in order to intimidate the other driver into moving over.

Roll your eyes in disbelief and wait for the car to move over or exit.

Get right on the rear bumper of the other car and honk your horn.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

Yes

No

14. You are in the right-hand lane behind another vehicle. When the right turn light is given, the vehicle does not move because the driver is not paying attention. You tap on your horn to get their attention and they give you the middle finger in their rear-view mirror. How do you respond?

Tap on your horn again.

Fume inside a bit, but do nothing.

Honk your horn.

Honk your horn and return the finger gesture.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

Yes

- No

15. You are travelling on a single-lane road late at night and the vehicle coming at you in the other lane has on high beams. You flash your lights, but the bright lights of the other vehicle do not change. How do you respond?

- Grit your teeth in frustration and wait for the car to pass so you can see again.
- Put on your high beams and honk your horn.
- Put your high beams on in retaliation.
- Turn around and follow the other vehicle with your high beams on.

a	1 - not at all	2	3	4	5 - very much
In the above situation, please rate how angry you would feel					

b Do you think the other driver's behaviour was intentional?

- Yes
- No

APPENDIX J

SHORT DARK TRIAD (SD3)

Please rate your agreement or disagreement with each item.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

It's not wise to tell your secrets.	○	○	○	○	○
I like to use clever manipulation to get my way.	○	○	○	○	○
Whatever it takes, you must get the important people on your side.	○	○	○	○	○
Avoid direct conflict with others because they may be useful in the future.	○	○	○	○	○
It’s wise to keep track of information that you can use against people later.	○	○	○	○	○
You should wait for the right time to get back at people.	○	○	○	○	○
There are things you should hide from other people because they don’t need to know.	○	○	○	○	○
Make sure your plans benefit you, not others.	○	○	○	○	○
Most people can be manipulated.	○	○	○	○	○
People see me as a natural leader.	○	○	○	○	○
I hate being the centre of attention.	○	○	○	○	○
Many group activities tend to be dull without me.	○	○	○	○	○

I know that I am special because everyone keeps telling me so.					
I like to get acquainted with important people.					
I feel embarrassed if someone compliments me.					
I have been compared to famous people.					
I am an average person.					
I insist on getting the respect I deserve.					
I like to get revenge on authorities.					
I avoid dangerous situations.					
Payback needs to be quick and nasty.					
People often say I'm out of control.					
It's true that I can be mean to others.					
People who mess with me always regret it.					
I have never gotten into trouble with the law.					
I enjoy having sex with people I hardly know					
I'll say anything to get what I want.					

APPENDIX K

AQ-15

The following statements ask you to describe how you interact with other people. There are no right or wrong answers, so please just describe yourself as honestly as you can. When you are ready to begin, read each statement carefully and decide how well it describes you.

	1 - Not at all like me	2 - A little like me	3 - Somewhat like me	4 - Very much like me	5 - Completely like me
My friends say that I argue a lot.	○	○	○	○	○
Other people always seem to get the breaks.	○	○	○	○	○
I flare up quickly, but get over it quickly.	○	○	○	○	○
I often find myself disagreeing with people.	○	○	○	○	○
At times I feel I have gotten a raw deal out of life.	○	○	○	○	○
I can't help getting into arguments when people disagree with me.	○	○	○	○	○
At times I get very angry for no good reason.	○	○	○	○	○
I may hit someone if he or she provokes me.	○	○	○	○	○

I wonder why sometimes I feel so bitter about things.					
I have threatened people I know.					
Someone has pushed me so far that I hit him or her.					
I have trouble controlling my temper.					
If I'm angry enough, I may mess up someone's work.					
I have been mad enough to slam a door when leaving someone behind in the room.					
When people are bossy, I take my time doing what they want, just to show them.					

APPENDIX L

Debrief Sheet

Thank you for taking part in this survey.

If you are concerned about any of the issues raised in the survey, you may find the following web resources helpful:

https://www.aaafoundation.org/sites/default/files/RoadRageBrochure.pdf

https://www.victimsupport.org.uk/

Please contact your local police force with specific concerns regarding road safety.

If you have any further questions about the study or wish to be informed of the outcomes once all data has been analysed, please contact the researcher by emailing msxlb1@nottingham.ac.uk. The earliest expected date for this is October 2017. Remember, your data is anonymous and will be stored by the primary researcher for 7 years in accordance with university guidelines and the Data Protection Act (1998).

The project is being supervised by Dr Ruth Tully, who can be contacted at ruth.tully@nottingham.ac.uk

Any complaints should be directed to the course director, Professor Vincent Egan, at vince.egan@nottingham.ac.uk

APPENDIX M

STUDY PARTICIPANTS NEEDED!

Are you aged 17 or over? Are you fluent in English? Have you driven in the UK in the last year?

If the answer to the above questions is yes, please participate in my study!

I am conducting an online survey regarding how people react to different situations experienced while driving, and how we make sense of other drivers' actions. I would really appreciate as many people as possible taking the time to fill it out. The study is completely anonymous and takes no longer than 20 minutes to complete (probably much less!).

Please visit the following link to find out more and to complete the survey: www.tinyurl.com/nottsdriving and encourage others to do the same.

Thank you! For more information please contact Laura Ball by emailing msxlb1@nottingham.ac.uk

Please tear off a strip below with the website details.

www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving	www.tinyurl.com/nottsdriving

Appendix N

Ethical approval letter

Faculty of Medicine and Health Sciences

Research Ethics Committee
School of Medicine Education Centre
B Floor, Medical School
Queen's Medical Centre Campus
Nottingham University Hospitals
Nottingham
NG7 2UH

Direct line/e-mail
+44 (0) 115 8232561
Louise.Sabir@nottingham.ac.uk

26th May 2016

Laura Ball
Trainee Forensic Pyschologist
Centre for Forensic and Family Psychology
Psychiatry and Applied Psychology
School of Medicine
YANG Fujia Building
Jubilee Campus, Wollaton Road
Nottingham University
NG8 1BB

Dear Laura

Ethics Reference No: G10052016 DFP SoM **– Please always quote**
Study Title: The role of attributions of intent and the dark triad in aggressive responses to driving situations.
Chief Researcher/Academic Supervisor: Dr Ruth Tully, Consultant Forensic Psychologist & Assistant Professor in Psychology, Centre for Forensic and Family Psychology, Psychiatry and Applied Psychology, School of Medicine.
Lead researcher/student: Laura Ball, Trainee Forensic Psychologist/PhD student, Psychiatry and Applied Psychology, School of Medicine.
Duration of Study: 05/2016-31/10/2017 18 mths **No of Subjects** 154 (18+ yrs)

Thank you for submitting the above application which was considered by the Committee at its meeting on 10th May 2016 and the following documents were received:

Attributions of intent and the dark triad in aggressive driving responses:

- FMHS Research Ethics Application form dated 02.05.2016
- Appendix A: Recruitment advert
- Research Proposal Final version 1.0 02.05.16
- Appendix A: Information Sheet Final version 1.0, 02.05.16
- Appendix B: Consent Form Final version 1.0, 02.05.16
- Appendix C Demographic questionnaire
- Appendix D UK Driving Anger Scale
- Appendix E BIS-11
- Appendix F Propensity For Angry Driving Scale
- Appendix G Short Triad (SD3)
- Appendix H Interaction with other People Scale
- Appendix I Debrief Sheet, Final version 1.0, 02.05.16

These have been reviewed and are satisfactory and the study is approved.

Approval is given on the understanding that the conditions set out below are followed:

1. You must follow the protocol agreed and inform the Committee of any changes using a notification of amendment form (please request a form).

2. You must notify the Chair of any serious or unexpected event.

3. This study is approved for the period of active recruitment requested. The Committee also provides a further 5 year approval for any necessary work to be performed on the study which may arise in the process of publication and peer review.

4. An End of Project Progress Report is completed and returned when the study has finished (Please request a form).

Yours sincerely

Professor Ravi Mahajan
Chair, Faculty of Medicine & Health Sciences Research Ethics Committee

Appendix O

Example item from the PADS

You are driving your car down a two-lane road. Without warning, another car pulls out in front of you from a parking lot. You had to break suddenly to avoid hitting it. How do you respond?

a) *Let out a sigh of relief and drive on.*
b) *Lean out your window and yell at the other driver.*
c) *Honk your horn to let the other driver know they almost caused an accident.*
d) *Follow the other car to its destination so you can give him a piece of your mind.*

Professional Doctorate in Forensic Psychology (D.Foren.Psy.)

Name of Trainee:	**Laura Ball**
Name of Primary Supervisor:	**Vincent Egan**
Thesis Title:	**Aggressive driving behaviour: A Forensic Psychological perspective**

This thesis contains a CD-ROM containing the raw data in an SPSS or Excel format used for this research, along with the relevant SPSS command and output files (or equivalent data for qualitative research), an electronic copy of the thesis, and a copy of the thesis without the references or appendices section. ☐

Turnitin report enclosed. ☐

This thesis has been reviewed before submission by the Primary Supervisor with the following comments:

This is a very satisfactory thesis and once all the elements above are appended and the minor revisions are made to my final suggestions, I think this is suitable for submission.

Vincent Egan, Sunday, 03 December 2017

Signed (Trainee): L Ball……
Date:03.12.2017…….
Signed (Primary Supervisor):

Date: …Sunday, 03 December 2017